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CIRCULAR No. 14.

U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF ROAD INQUIRY.

ADDRESSES ON ROAD IMPROVEMENT.

The accompanying addresses on improved road construction contain information which is the subject of frequent inquiry at this office. It is believed that their publication in the form of a circular will afford the most convenient form of answering a large part of the correspondence of the office and aid in increasing the growing interest in good roads.

ROY STONE,
Special Agent and Engineer.

Approved:

J. STERLING MORTON,
Secretary.

ADDRESS DELIVERED AT THE SOUTHERN IMMIGRATION AND INDUSTRIAL CONGRESS, AUGUSTA, GA., JUNE 1, 1894.

I can not claim fitly to represent the Department of Agriculture on this occasion; yet I can assure you that in the great work you have undertaken you have the hearty good-will, sympathy, and coöperation of every officer of the Department, from the Secretary down. You have only to indicate where and how they can serve you to command their active help in every lawful way. Your work is akin to theirs. You strive to extend agriculture, they to improve it. You seek to open regions where the highest possibilities of agriculture lie undeveloped. Science can well join hands with enterprise in bringing these possibilities to light. With a climate and soils adapted to the most varied production, you interest the specialist in every branch of agriculture, and you will reap the benefit of his knowledge and enthusiasm and his influence over capital and skill.

For my own part, though I have no share in the general work of the Agricultural Department, there may be a special fitness in my being

here as its representative to-day. You desire to draw immigration to your vacant lands. What better inducement could you offer to immigrants than a certain prospect of good roads to market? If you could add this boon to all your other advantages over other sections, you would capture settlers by the thousands. Apparently, therefore, the greatest service the Department can render you in the outset of your work is to point out any possible way to secure this advantage. And, first, let me say that in its work for roads, the Department does not propose to do anything officious or paternal. It simply furnishes a rallying point for the friends of the reform and a signal tower from which its progress can be watched and reported day by day.

From this outlook we have already seen much that is full of hope. Road-building is actually progressing in many parts of the Union, and it has been carried on in some cases with such economy in construction, such equity in distribution of the cost, and such ease to all concerned, that hereafter no community need think itself too poor to have good roads.

In point of money cost, you have great advantages here over other sections of the country. You have cheaper labor, you can work at road-making in the winter, and you do not have the deep frosts that destroy the Northern roads unless their drains and foundations are deeply laid. With these advantages, which are half the battle, and with prompt action by all your State governments, you can put yourselves in a position where you will need no conventions to promote immigration. You need only to point out the regions where farmers are actually getting rich in these hard times, by reason of their good roads, and give a reasonable assurance that the same blessing will be extended to every portion of the land you offer for settlement. You have another advantage over the prairie region and another inducement to build roads in advance of the settlement. Most of your unoccupied lands are covered with timber, which must be destroyed if it can not be marketed; with good roads it can often be made to pay for the lands, for the clearing of them, and for the roads themselves. On the other hand, its destruction is a cruel waste and a heavy tax in labor. In foreign countries, where forests are protected and managed for revenue, it is found profitable to build good roads through them for the removal of the surplus product alone.

Through the kindness of Prof. Fernow, chief of the Division of Forestry in our Department, I am able to give you a very apt and concise illustration of this fact.

The little city of Goslar, in the Hartz Mountains, owns a spruce forest of 7,000 acres, which, by careful management, permits an annual cut of 300,000 cubic feet of wood and pays a net revenue of \$25,000 per annum. Within a few years the city has macadamized the leading roads through the forest, and a very careful system of accounts shows the following results:

Full load on old road, 85 to 100 cubic feet; full load on new road, 175 to 250 cubic feet. Average cost of hauling per 1,000 feet B. M., old road, \$2.70; average cost of hauling per 1,000 feet B. M., new road, \$1.70; saving per 1,000 feet B. M., \$1; cost of improvement, \$25,000; profit per annum, 10 per cent.

These facts show some of the advantages of road improvement where it is practicable.

But the main question is, How can a people having no surplus capital build good roads? For an answer we must go where they have done it successfully, and study the methods adopted; we can certainly follow these methods; possibly we may improve upon them. First, we must study all the economies possible in construction; second, we must find out all the parties to be benefited, and see that each bears his proper share of the cost, whether or not he belongs to the immediate locality, or even to the present generation of men; third, we must look into the local questions of road materials and transportation, and into all the latest improvements in road implements and machinery.

But who is to do all this? And that brings us to the first practical step in general road improvement; namely, that every State should have a permanent commission composed of citizens of the highest character to undertake this investigation and recommend the necessary measures to the legislature, to watch the workings of those measures when adopted, and to secure any possible improvement in them.

The next step, and one in which you are much in advance of the Northern States, is to make the best possible use of convict labor in road-building. My own impression is that State prison convicts will be best employed in the preparation of road materials, in quarry camps, or gravel pits, where they can be guarded and secluded as easily as in prisons, and that county prisoners and tramps should do the grading and other preparatory work on the roads.

In regions where rock is plenty, by using the best machinery for crushing stone, and employing the convicts only in quarrying and handling it, an amount of material could be produced sufficient to macadamize all the roads in the State as fast as they could be prepared, and, in addition, to furnish ballast for the railroads as a consideration for their giving reduced rates on road materials.

Of their own motion, the railroads are ready to contribute largely in this way toward road improvement. In their correspondence with the Department of Agriculture on the subject, many have proposed to make half rates or haul at bare cost whenever a general advance toward road improvement shall begin, and the State commission would be in a position to make better terms with them than any private individual or local authority, and better than we could do on behalf of the General Government without the power to offer any definite assistance on its part in return.

The Southern railroads are especially farsighted and liberal in this regard, and I have no doubt that when they are approached with the full authority of the States, and with the assurance that their coöperation will secure general action for road improvement, they will consent to move road materials for the bare cost of the train service required.

This will be an economy especially important in the extreme South, where materials must be moved long distances. Other economies are being developed as road-building becomes an American occupation, and opens a field for the business capacity and ingenuity of our people. The transfer of materials from cars to wagon without hand labor or expense, and the mechanical spreading of the same upon the road without cost, are already accomplished experimentally, and will soon come into practical use, with a saving of 15 or 20 per cent of the cost of all roads for which the material is moved by rail.

Taking it for granted that the best wisdom of the State will shape its legislation for road improvements, and that science and skill, ingenuity and business talent, will all combine to produce the best results at the least outlay, we must come to actual figures of cost and definite plans for financing before the final answer to our question can be given.

One serious hindrance to the extended building of hard roads has been the expense of some of those built and the general overestimate of the cost necessary. An expense of \$5,000 per mile is beyond the possible means of most country districts, but our inquiries have developed many cases where good stone roads are being built for one-fourth of that sum. The stone roads of Canandaigua, N. Y., cost only \$900 per mile. They are not wide roads, but are heavily stoned, and they are so good that when I was there, in the midst of a January thaw, the farmers living on them were hauling 2 tons of hay on a 2-horse wagon, while the neighboring dirt roads were practically impassable.

Wide roads are not required in an ordinary farming section. A single track of stone with an earth track alongside is in many respects better. Without going into details, I judge that such a road can be built on the average in the Southern States, with paid labor, for \$4 per rod. Supposing the road to be built with such labor, and paid for upon the State-aid plan adopted in New Jersey, as modified in an act lately passed by the assembly of New York, the cost would fall equally upon the benefit district, the county, and the State, the benefit district including the habitual users of the road, and estimated to extend an average of 1 mile on each side of it; the lands of the users would be assessed in proportion to their benefits for one-third of the cost, payable in ten annual installments, with interest, beginning one year after the completion of the road, the county meanwhile advancing the money and having authority to issue short bonds for this purpose and long ones for its own share.

The cost of the road, at \$4 per rod, would be \$1,280 per mile, and the benefit district would contain 2 square miles or 1,280 acres for each mile

of road, thus making the cost \$1 per acre, of which one-third falls upon the district; this one-third, spread over ten years, would be less than 4 cents per acre yearly, including interest. The county would recoup itself largely by the saving in cost of road repairs and the State by the increase in taxable values.

Nearly the same result would be reached if convict labor were used in the manner I have proposed (the State furnishing road material free on board cars as its quota toward road construction). The cost to the State above the usual care, maintenance, and guarding of the convicts would be only that of the necessary fuel, oil, explosives, and repairs of machinery, amounting, according to the report of the Massachusetts highway commission, to 6.8 cents per cubic yard of stone crushed, or for the 1,200 yards required to lay a mile of road 9 feet wide and 8 inches thick, to \$81.60.

The additional items in the cost of the road would be the railroad freight, which, if based on bare cost, would not exceed 25 cents per cubic yard for an average of say 75 miles, and which for 1,200 yards would be \$300, and the wagon haul of an average distance of perhaps 3 miles, 40 cents per yard, or \$480 per mile, making \$780; adding 10 per cent for incidentals, makes a total of \$858 per mile to be shared between the county and the benefit district or about the same amount as before, the advantage of using convict labor accruing wholly to the State.

Supposing that the State will aid in road-building in either of these ways, the question then resolves itself into this, whether the local property can bear the local tax and whether the county can borrow the money needed.

As to the first part, the present average tax for road purposes, including labor, is about 10 cents per acre; adding 4 cents to this for ten years would be a slight burden for so great a benefit, and it would lighten the tax forever thereafter by diminishing the cost of repairs on the roads.

The New York Highway Manual, by careful computation, makes the annual value of good roads \$1.25 per acre. If this be correct, the beneficiaries would only be paying one-thirtieth of what they receive.

As to the second part, I will not enter into the question whether the counties *ought* to issue bonds for this purpose. Enough of them will be found *willing* to do it to make a start, and the others will follow rapidly enough. I have found no case where a county regretted having issued bonds, even for the entire cost of building expensive roads, running up to \$5,000 or \$10,000 per mile. Certainly no county will regret it if good roads can be secured for an issue of less than \$500 per mile in long bonds. The issue of short bonds to cover advances on behalf of the district is practically no indebtedness, as interest and principal are both to be paid by the district, and the county has full power to enforce payment through taxation.

The issue of long bonds, moreover, is the only way in which the road users who come after us can be enabled to contribute *any* share toward the cost of an improvement of which they will receive a *full* share of the benefit.

The only point remaining to be considered is whether the money can be had on the credit of the counties. I believe not only that it can be had, but that county road bonds, with a proper supervision of their issue by the State and a State inspection of the expenditures to guard against waste, will become a favorite investment, mainly for the reason that they *multiply their own security*. Every dollar well invested in road-building adds \$10 or \$20 to the value of adjacent property.

The Canandaigua farmers, who built their roads at a cost of \$1.50 on each acre of the abutting farms, find those farms worth \$20 to \$30 more per acre, either to sell or work, and this is but one of a hundred like instances.

You are studying how to get Northern capital. This is one way to get it and to put it where it will do the most good; where it will count for its highest value and count twice over. Besides bringing you good roads and all the blessings in their train, every dollar of it will linger among you as an addition to your home capital.

Money paid out among farmers is applied to the fountain head of all business, and from there it will ultimately flow downward, filling all the channels of trade, production, and finance. Your farmers say they have not the money to build good roads, but they will be glad to work for the money if others provide it, and then they will have both the roads and the money that built them.

In conclusion, I can not hope in these few words to convince many of you that it is possible to build good hard roads in every part of the South in the very near future, and perhaps I should not have asked your attention to the subject on this occasion, when your hearts and minds are full of other things; but if you will take my suggestions home with you, and especially if in every State you will endeavor to put some of your best men in position to study this subject thoroughly and authoritatively, I shall not have spoken in vain, nor, I believe, in the end will the cause you are especially engaged in have suffered at my hands.

ADDRESS TO THE BOARD OF CHOSEN FREEHOLDERS OF MORRIS
COUNTY, N. J., AUGUST 8, 1894.

I congratulate you upon the good work which you have started in this county. You are pushing the county to the forefront by adopting at once a resolution to go to the full limit of your power in the building of stone roads. And if you are willing to take instruction from other counties, and particularly from counties outside your State, you will possibly take the lead of all the counties of your own State and be in the forefront of progress in the United States.

The question of good roads is being worked out differently in differ-

ent places. The object of my work in the Department of Agriculture is to bring the methods and results in one section to the knowledge of people in other sections.

We find that there is a vast amount of road-building going on in the United States, and the best roads that I have found are the cheapest roads. That is surprising, and it is encouraging. The building of roads began with an expenditure of \$10,000 per mile, and those roads to-day are not giving as much satisfaction as some of the roads built for \$2,000 per mile.

I estimate the cost of building macadam roads in this county at from \$2,000 to \$2,500 per mile, and for that amount I think you could build excellent roads. And you will be able to build roads in this county without feeling the burden at all. Your county taxes will not be increased, because you will bring in enough foreign capital to increase the valuation of property as fast as you increase your taxation. The final result will be to diminish taxation. The result in the townships will be somewhat heavier taxes at first, as they have to pay one-third of the expense down, or within a few years; but they will get all this back in not having to repair the roads, which become county roads and are kept in repair by the county. The townships by paying say \$700 per mile will save \$50 per mile, which they now pay annually for repairs—equal to a 7 per cent investment.

Now as to methods of construction. Get your locations right first. It will be necessary for your engineer to lay out better locations for many of your roads. It would be folly to spend \$2,000 or \$3,000 on a section of road and find that it was in the wrong place when finished. And if an individual loses by being thrown off the highway or by having the road cut through his farm, the county will have the power to compensate him out of the county funds.

You are somewhat hampered by the law under which you are working, which compels you to build a road 12 feet wide in the middle of the way. That is a serious drawback, but you can easily get the law amended. In a country district you don't need a road 12 feet wide. You need only a single track of stone road. You would do better with an earth road 8 or 9 feet wide and a single-track macadam road alongside of it, or have a single-track macadam in the middle and an earth road on each side of it. That is being done now in Michigan, North Carolina, Ohio, and Georgia; and in Canandaigua, N. Y., they have built satisfactory roads with one track of macadam and a shoulder of earth on each side for \$900 dollars per mile. An earth road is better than a stone road when it is good, but when they are side by side you have the best road all the time for you have your choice. And this will only cost you about half as much, while the cost of repairs will be much less than half.

The wear on a stone road is almost entirely in dry weather. The stone becomes loosened on the surface, and if one stone becomes loose

the next one does also, and so on. The loose stone becomes crushed very soon and the dust is washed or blown away. If a stone road is not used in dry weather your repairs will be almost nothing for a good many years.

There was great apprehension, in the beginning, of trouble in passing teams on the road, but you won't experience any difficulty in that respect. The two tracks merge into each other, so that the junction can not be seen, and, moreover, your earth road, never being used when it is wet, is always hard enough to turn out upon it, and it may be months before two teams will need to pass at the same place in the road, so it is never cut up by turning out.

Upon the question of the cost of these roads in this county, I should think with the amount of surface stone I see about here that you could build as cheaply as any section of the country, though you may have to bring material by rail from the trap-rock hills in neighboring counties to surface the roads. I would put a good depth of common country stone, I should say about 9 inches, all broken; and then about 3 inches of a better class of material on the surface. The difficulty with macadam roads in many places is that they are built of material that does not stand the wear. It wants a very uniform material for the surface, so that the road will wear down evenly and smoothly.

I would plow up the whole surface of the road, and on the side where you want the earth road remove all the stone and put most of the dirt on that side. Where you want the stone road, remove the dirt and roll it thoroughly and make it hard, laying tile drains if there are wet places. Then drop in 3 or 4 inches of broken stone and then 3 or 4 inches of finer stone, making it finer and finer, and place screenings on the top. The roads should be left in the contractors' hands for nine or ten months after building, so that they can stand the test of a winter and spring; and then he can fix up any bad places in the roads before turning them over to the county.

If you adopt this system you will be able probably to build 100 or 150 miles more of road for the same money, and the roads will give better satisfaction than wide stone roads.

We do not know exactly the cost of keeping these roads in repair, as we have not yet had the experience upon this class of roads; but for the first four or five years the cost would be trifling. There is no question but that it will be less than the cost of keeping earth roads in repair. I do not think that you will need to spend over \$30 per mile on repairing your roads for the next ten years.

If you adopt this system of roads people will want to come here and see roads that are built according to the most modern ideas, and find how they are liked and how the people stand the taxation. I am interested in having you adopt the best system, because your county is so located that I can use it as a show place to exhibit the best and cheapest roads and so promote road improvement all over the United States.

ADDRESS TO THE CHOSEN FREEHOLDERS OF MORRIS COUNTY, N. J.,
SEPTEMBER 12, 1894, ON REDUCING GRADES OF COUNTY ROADS.

When I spoke to you last month on the great work you have undertaken I had but little knowledge of the special difficulties of your task, and could only congratulate you on what you had already done and offer some general suggestions for the economical construction of your roads.

To-day I can speak much more definitely. I have driven over a great part of the county to see what your roads are and what you can make of them, and I am compelled to say to you that in my opinion throughout three-fourths of the county you can do no good by macadamizing the roads unless many changes are made in their location. On the contrary, you will do great harm, for you will prevent the making of such changes in the future.

Any costly resurfacing of the existing roads will fasten them where they are for generations. Your chief difficulty is not with your road surfaces, but with their high grades, most of which are too long to be reduced by cutting and filling on the present lines. Your roads were laid out, as is the custom in this country, without any attention to the general topography, and generally by following the settlers' path from cabin to cabin or by running along their farm lines, regardless of grades or direction; and most of them still remain where they were laid and where untold labor has been wasted in trying to improve them.

No hilly region was ever better provided with natural roadways. Low summits divide the waters of all your great intervalles, and all your high plateaus have gently sloping valleys leading up to them. But your roads climb the steep hillsides, or, where they follow the valleys in the main, they cross all the foothills they come to instead of skirting them. It would have been worth many millions to you to have had them systematically and skillfully laid out in the beginning.

Your hill townships would have been rich and prosperous to-day and your towns would have shared in their prosperity. All your leading roads would have been kept down to the limit prescribed for hilly regions in other countries; that is, to a 4 per cent grade, or 4 feet rise in 100, instead of 10, 12, or 15 per cent, as you have them now. And if this had been done, one-half the cost of all the hauling that has ever been done to and from your farms and forests, mines and manufacturing mills and stores would have been saved. How much would this have amounted to?

Take the Mendham and Morristown road, for example: running from one place to another in the same valley, it goes over four great hills; its traffic is drawn from a large territory, but the township of Mendham alone, at the low estimate of half a ton per acre carried annually, out and in, and at the rate of \$1 per ton extra for the hills, pays a hill tax of \$7,000 per year on its 14,000 acres. At the same rate for the other hill townships the total tax is over \$100,000 per year.

This is the burden you now have the power to lift off or to fasten on those townships forever. Multiply it by 100 and add fifty years' interest, and see what it would have been worth to have dropped it a century ago. If these figures seem extravagant, go over them for yourselves.

The average haul from the hill districts is not less than 8 miles, and \$2 per ton is not high pay for it. You will not doubt the saving of one-half of this by cutting down the hills if you look at the 4 per cent grade in Court street, alongside this building, and then at the 10 per cent hill above, which is less than the ruling grade on most of your roads.

As to the amount of haulage per acre, if the whole district were in thrifty timber, its yearly growth would be over 1 ton per acre (as is shown by the German forestry reports), and its present marketable product, with all the incidental hauling, can not well be less than half as much.

You are the first body which has ever had any authority over the road system of the county, or which could take up the subject from the high standpoint of the general public interest. It is true, your authority in the matter is only negative, but it is none the less absolute. You can not change a single road, but you have only to say that you will not waste the county's money in stoning roads which are mislocated, and the roads will be promptly changed as you require. If not, you can wait, and you are quite as much responsible for the final result as if you had full power to make changes.

It is clearly in your power to adopt a limit of grade above which you will not improve any road unless for special reasons shown. I am sure you will be justified by the people of the county in fixing a low limit and applauded for spending a large portion of your funds in reducing the roads to that limit, either by cutting down hills or by going round them where it is necessary. This improvement is of ten times more consequence than improving the road surfaces where they are hilly.

In the first place, you cannot materially improve the surface on a steep hill by stoning it, for it is naturally dry and hard. In the second place, for eight or nine months in the year your surfaces, for either wagons or sleighs, are good enough, while the hills will reduce your loads all the year round. According to the best authorities you can not gain more than a quarter or a third by macadamizing on a 10 per cent grade, while by cutting that grade down to 4 per cent you can double your load; and then you can double it again by macadamizing.

The 4 per cent limit is fixed wherever it is practicable, because it is the highest grade which a horse will trot up with ease and trot down at full speed with safety. And again, for loaded teams, it is found that a horse by extra effort can pull twice as much for a short time as he can for all day, and on a fair stone road a 4 per cent rise will just

double the pull that is required on a level. So that a team loaded for a long pull on a level stone road will take its load up a 4 per cent hill without difficulty, by resting occasionally if the hill is long. With your hills reduced to 4 per cent and the roads stoned, farmers will be able to haul loads of 4 tons in all parts of the county, as is done now on the "State-aid roads" in Camden and Burlington counties.

Some of the manufacturers in this county have paid and are still paying a higher hill tax even than the farmers. The road from Morristown to Whippany, which should have been a straight and easy descent of $3\frac{1}{2}$ miles, takes $3\frac{3}{4}$ miles and goes over three hills, with a total rise both ways of 400 feet. One hundred and fifty tons of coal and mill freight are hauled daily over this road. The extra distance, and the hills, which are equal to 2 miles more, render it impossible to make more than two trips a day, and, though very strong teams are employed, and loads of $1\frac{1}{2}$ to 3 tons are hauled, the cost is 80 cents per ton.

With a straight stone road, descending in the direction of the heaviest traffic and ascending by light grades in the opposite direction, the same teams would make three trips (21 miles) and double their loads, thus reducing the cost to 27 cents per ton and saving \$2,000 per month. This sum, then, is the hill tax and mud tax combined, and the former is clearly three fourths of the whole. The whole tax would build the new road in nine months.

Many other roads in the county are worse even than those to Mendham and Whippany. From Beonton to Butler the road is steep and stony, and half a mile longer than the valley alongside. Returning from Butler through the great valley region of the county, I expected to find a fine highway to the county seat, but at Pompton Plains I was told there was no road to Morristown; that all the travel was to Newark and Paterson; and it is true there is no road through that straight and level valley. To reach Morristown I turned sixteen square corners and climbed up and down 2,150 feet of hills, making a hard half day's journey of what should have been an easy two hours' drive.

If the new road to Whippany is made, an extension of 8 miles through the meadows and a cut through the rock ridge which divide them from the plains will open all the northeastern part of the county, and the cutting will cost nothing, as the rock is good road material. The northwestern section of the county can be equally benefited by cutting through the summit at Green Pond Mountain on the Hamburg pike (which is also good rock in boulders) and passing around Maize Mountain through the adjacent valley without increasing the distance while avoiding one of the most difficult and dangerous passes in the county.

The great thoroughfare through from Essex to Sussex is well laid and graded from Chatham to Morris Plains. Thence westward it is crooked and hilly, but it can be straightened and shortened and the hills avoided, except for a gentle rise to the higher level of the lake. In the western part of the county, Mount Olive, Schooleys Mountain, and Chester can all

be reached from both sides by 4 per cent grades, and Mount Freedom can be crossed at 3 per cent, with less than half a mile increased distance.

For the whole county 75 to 100 miles of new road will be needed, which, if well built, will take one-third of your whole fund. But it will be money well spent, and will give you a splendid system of highways upon which to commence your surface improvement. But, as the Spaniards say, "you can not make omelets without breaking eggs," and you can not correct the mistakes of four or five generations without hurting somebody. You will encounter violent opposition to many of the necessary changes, and your great danger will be in yielding to local influences before there is time for the public to come to your support. But if you go slowly at first, if you fix your limit and do not allow yourselves to be rushed into any departure from it until you are sure that the whole county will justify you, all will be safe.

Many of those who fancy they will be hurt by the changes will find themselves benefited instead, and if you simply mark out your new lines and postpone action on them till the people are familiar with their advantages, you will find your way made easy in nine cases out of ten. If, on the other hand, you make no limit and throw the whole burden of locating the roads upon the local freeholders in each case, unless they are more than human your whole system of roads will be sacrificed to neighborhood influences, and you will have a beggarly piece of patchwork, with the old hills and hollows, crooks and turns, perpetuated, and nothing to show for your county debt and extra taxation but a wasted opportunity and a bar to good roads for all time to come.

ADDRESS TO THE FARMERS' NATIONAL CONGRESS, PARKERSBURG,
W. VA., OCTOBER 5, 1894.

MR. PRESIDENT: The Acting Secretary of Agriculture desires me to make his greeting to the Farmers' Congress, to express his regrets that official duty deprives him of the pleasure of meeting the delegates on this occasion, and to say a word upon the subject announced in your programme, "The relations of the Department of Agriculture to the farmer."

For this duty no officer of the Department would probably be less well prepared than myself. Representing the very latest, if not the least, of all the countless beneficent activities of the Department in behalf of the farmer, I have had no time to inform myself as to the work of other divisions or the general policy of the Department. I have seen enough of its workings, however, to impress me with the vastness of its field of effort and with the earnest, faithful, and intelligent work that is being done; enough, also, to show me some of the limitations of its work and the want of means to carry out some of its most important functions. The great aim of the Department is to extend, improve, and

diversify agriculture, and to find satisfactory markets for its products. The energies of its whole corps of scientific and practical workers are bent in this direction; yet, notwithstanding all the multitude of keen eyes, of skilled hands, and trained minds which it employs in spying, and prying, and studying into the mysteries of nature, the conditions of vegetable and animal life, their secrets of health and disease, and into all the intricate relations of agriculture to commerce, including the production, distribution, and consumption of everything that grows, there is still so much territory for investigation remaining unexplored, for want of means, that the whole work seems but a beginning. This is illustrated by the striking fact that every working day we import into the United States \$1,000,000 worth of agricultural products which we could and should produce at home.

A little while ago it was the fashion to decry the services of the Agricultural Department to the cause of agriculture, but it is so no longer, and the best thinkers realize that if it had been the first instead of the last Department in the formation of the Government, it would have come nearer to its proper scale of importance.

No man can conceive of the wealth and prosperity this country would have attained if its entire agriculture had been well directed and wisely aided from the formation of the Government.

It is not too much to say, that in all the older States of the Union one-half of the labor of the entire population for generation after generation has been wasted in trying to make farms where nature only intended to grow forests, or to grow grains where nature only intended grasses.

No other government in the world would have permitted its people to sacrifice themselves so needlessly through their own ignorance. The government would have laid its hands on the mountain districts of the Appalachian chain, and said: "These are our forest preserves for future generations." It would have opened roads and waterways to the prairies of the West, and said: "Here is your land for cultivation." But with us every settler has been left to his own devices, with no help or encouragement to reach out to the good lands of the West, and no advice as to the real value of the timber which he must destroy to make a farm in the forest; he has blundered on, slashing and burning, grubbing and clearing, often only to uncover a thin, sterile soil, which is worn out long before the stumps are rotted, leaving him too poor to buy fertilizers to restore it; and after years of labor he finds that the native forest would have been worth ten times as much as his farm, with all its improvement, and discovers that if he had worked out by the day and invested his savings in timber lands he would have made a better living for his family and a fortune for his children.

There is no sadder picture in all the world than the last days of the old farmer who has wasted the courage of a soldier, the patience of a martyr, and the strength of a giant in a lifelong struggle with the

forces of nature in a rugged mountain region, and who finds himself poor and forsaken at the end, while all his life, just over the mountain, the smiling prairie has wooed his coming and waved him welcome to a happy home, its eager soil waiting only "to be tickled with the hoe to laugh with a harvest."

I do not speak without knowledge of this phase of country life. In my boyhood days in western New York I have seen magnificent forests, a single tree of which would be to-day worth more than an acre of the land it grew upon, cut down and piled up with painful labor to be burned for the ashes, out of which a little potash salt could be made, to be carried 100 miles to market and exchanged for merchandise. What a picture of criminal folly and waste!

A well-ordered Department of Agriculture established in the early days of the Republic would have made this almost impossible.

So much, and more, the Department might have done in the past. What it is doing now, and what it may do in the future if properly supported, would take more time in telling than you could spare for listening, and I must come at once to my own subject, "The improvement of highways as it affects the farmer."

Among the taxes which the farmers pay there are some that are unavoidable, and these it is useless to talk about. There are others which farmers impose upon themselves, which they hesitate to share with others, which they submit to without a protest, and even cling to when they are being removed. These taxes we can not talk about too much. These are taxes, too, which bring no useful revenue, nor even support a taxgatherer; they are burdens as needless as the traditional stone which balanced the grist on the way to mill.

Through the failure of the Government in the original surveys of the public lands to lay out a scientific system of roads, and divide the lands accordingly, farmers have been left to lay out the roads for themselves, and generally they have put them on farm lines, going over all the hills that come in their way. The result of this is the hill tax in hilly regions and what may be called the square-corner tax on the prairies.

The amount of hill tax I have estimated in one county in New Jersey, and found that needless hills double all the cost of hauling in the county, making practically a money tax of \$10,000 annually to the township. The people have paid this tax for one hundred years, and yet they wonder why they are poor. In the prairie regions, for want of the diagonal roads which the Government should have laid out, the farmer, to reach a point 10 miles to the northwest, for instance, travels 7 miles north and 7 miles west, adding 40 per cent to his distance, or, for the average of all travel, 20 per cent. This is the square-corner tax.

The mud tax is probably about equal in total to the hill tax, and this, again, doubles the cost of all wagon transportation; yet many farmers are opposed to stone roads.

However, the farmers themselves are doing away in many places with the enormous burden of the fence tax, and with it will go the snowdrift tax and the waste land on the roadside. They are slowly abandoning narrow tires and tracking wheels. Moreover, many of them begin to realize the enormity and absurdity of the hill, mud, and square-corner taxes, and we may yet hope in time to see in this country, as we do in France, beautiful hard roads everywhere, winding through farms, with crops growing close to the wagon tracks and the roads serving perfectly every purpose of public use and private convenience.

You ask how all this can be accomplished without a burden of taxation, which will neutralize its benefits. I answer that it is all being done to-day in a hundred places in the United States, and there are farmers who acknowledge that they are getting rich in these hard times solely by reason of the improved roads which have been forced upon them, and are paying with perfect ease any additional tax they impose. These improved roads are being built in many ways and in various forms of construction, and every year's experience reduces the cost and brings about an easier providing of the necessary means.

It would be a very long story to go into the details in this direction, and I would not be prepared to say which is the best of the many methods of construction and of payment. Both need to be greatly varied to meet the conditions in the various States, and a careful study of local legislation is necessary; but the vital question is for the farmers themselves to settle generally whether they want good roads and whether they will accept the help of those who are willing and anxious to join in paying the cost of road improvement. If they will take up the subject in all their organizations and appoint active working committees to visit the nearest accessible localities where good roads prevail, and to urge such legislation as will make them attainable everywhere, the work will soon reach a point where its own momentum will carry it forward.

The estimate of your able secretary, that \$600,000,000 is wasted annually in this country through bad roads, is supported by that of other statisticians, and from this it appears that the tax they impose takes one-quarter of the whole value of all farm products in the United States. To abolish this tax is a reform great enough to engage the best attention of this congress. It is a practical and practicable field for its energies. What the congress says on this subject will be listened to everywhere, while what it says on other subjects may fall on deaf ears.

In conclusion, whatever this congress or any other farmers' organization may desire to do in this behalf I may assure it of the cordial and hearty coöperation of the Department of Agriculture, and especially that of the Division of Road Inquiry.

U. S. DEPARTMENT OF AGRICULTURE.
OFFICE OF ROAD INQUIRY.

WASHINGTON, D. C., October 31, 1894.

The act to provide for the construction of roads by local assessment, county, and State aid, submitted herewith for publication as Circular No. 15 of this office, was passed by the Assembly of the State of New York near the close of its last session by a vote of 84 to 21. It was not reached in the Senate and did not become a law; but it is based upon the effective State-aid law of New Jersey, modified and improved in some details by the advice of the framers and administrators of that law, and is probably the best development of the State-aid plan of road construction. It will therefore be of interest to legislators in other States.

ROY STONE,
Special Agent and Engineer.

Approved:

J. STERLING MORTON,
Secretary.

AN ACT TO PROVIDE FOR THE CONSTRUCTION OF ROADS BY LOCAL ASSESSMENT,
COUNTY, AND STATE AID.

The people of the State of New York, represented in senate and assembly, do enact as follows:

SECTION 1. *Petition of bordering land owners for survey and estimate of cost of local road; subsequent petition of residents of benefit district.*

On presentation to the board of supervisors of any county of a petition signed by the owners of not less than one-third of the lands bordering on any section of road already established or proposed to be established in such county asking for a survey and estimate of the cost of building or rebuilding such road in a substantial and permanent manner either of stone or gravel as prescribed in such petition, such board of supervisors shall cause such survey and estimate to be made for the information of such petitioners and shall forward a copy thereof to the State engineer. Whenever thereafter the petitioners shall present to such board of supervisors a map or description of the lands which, in their opinion, will be directly benefited by the construction or improvement of such road, together with a written request of the owners of three-fifths of such lands, that all the lands so benefited and the personal property in such district be assessed, in proportion to the benefits conferred for such construction or improvement, to the amount of one-third of the total cost thereof, such board of supervisors shall cause such road to be constructed or improved. Such lands so mapped or described shall be known as the benefit district of the said section of road. But whenever the original petition in any case shall set forth that the area to be benefited by the road is peculiarly restricted by the prox-

imity of other roads or by other circumstances, an examination and report shall be made by the supervisor of the town and the surveyor of the road, and if it appears thereby that such area is less than 2 square miles for each mile of the road to be built, then the proportion of cost required to be paid by the benefit district shall be diminished at the rate of $3\frac{1}{2}$ per cent of the whole cost for the first 100 acres of such deficiency and 3 per cent for each additional 100 acres of such deficiency, but shall in no case be less than one-tenth of the whole, and the balance of the cost of such construction shall be equally borne by the county and State.

SEC. 2. *Applications.*—Copies of all maps and descriptions and requests of property-owners residing within the benefit district accompanied by an application for State aid shall be transmitted to the State engineer, who shall file the same in his office and record the date of the receipt thereof. State aid shall be accorded to the various benefit districts in the order of the date of the receipt of their applications, and when such applications shall be sufficient to exhaust the appropriation made for such purposes the State engineer shall notify the applicants and the county board of supervisors and all liability for State aid shall thereupon cease. Whenever any subsequent appropriation is made it shall be first available for the applications already on file in the order of their receipt. No State aid shall be allowed to any section of road unless the State engineer shall certify that such road is, or will be, a main traveled road and a proper subject to receive State aid.

SEC. 3. *Construction of road.*—Such road shall be constructed or improved according to plans and specifications furnished by the State engineer and shall conform to the survey and estimate of cost provided by the board of supervisors. The contract for such construction or improvement shall be let by the board of supervisors to the lowest bidder upon the publication of a notice once in each of four successive weeks in two newspapers published in such county, stating where a copy of the plans and specifications of the proposed construction or improvement may be obtained and the time and place where the board of supervisors, or a committee thereof, will meet to receive bids. The cost of the publication of such notice shall be a county charge. Each of such bids shall be accompanied by a bond, with satisfactory security in a sum to be determined by the board of supervisors, conditioned that if the contract shall be awarded to such bidder he will execute an agreement, in writing, to perform the work according to the plans and specifications and terms of the contract. Such contract shall be executed in duplicate by the chairman of the board of supervisors under the direction of the board, one of which shall be retained by the contractor and the other filed with the clerk of the board. A copy of each contract shall be forwarded to the State engineer to be filed in his office. Before beginning the construction of the work under any contract the State engineer shall appoint a competent person as superintendent of such work, who shall receive as compensation a sum not to exceed \$4 per day, to be paid in the same manner as other employes in the State engineer's department, out of the moneys appropriated for that purpose. Such superintendent shall supervise all work done under the contract and require the provisions thereof to be strictly adhered to by the contractor. The contract may provide that partial payment shall be made to the contractor during the progress of the work, in which case such superintendent shall, as each payment becomes due, make a certificate to the chairman of the board of supervisors, stating the amount of work done and that such work has been done according to the provisions of the contract, and thereupon such chairman shall direct payment to be made by the county treasurer to an amount not exceeding 80 per cent of the value of the work performed. When the work under the contract shall be fully completed the superintendent shall make a detailed and itemized statement, in duplicate, of the cost of the construction or improvement, one copy of which shall be filed with the secretary of the board of supervisors and one with the State engineer. When such roads are completed they shall become county roads and thereafter be maintained at county expense.

SEC. 4. *County engineer.*—A county engineer may be employed by the board of supervisors whenever required under the provisions of this act. Such engineer shall have general supervision of the construction of all roads built under this act and shall have power to suspend any superintendent of construction appointed by the State engineer for neglect of duty or incapacity, subject to the final action of the State engineer; during such suspension he may appoint a substitute, who shall be entitled to the pay of such superintendent.

SEC. 5. *Payment of cost of construction.*—Except in cases where the benefits are “peculiarly restricted,” one-third of the total cost of the construction or improvement of such road shall be paid by the owners of the land and property in the benefit districts, which amount shall be assessed upon such owners according to the benefits derived by them; one-third shall be a county charge, and the remaining one-third of the total cost shall be paid by the State treasurer to the county treasurer upon the warrant of the comptroller and the certificate of the State engineer that the road has been properly constructed according to plans and specifications furnished by him.

SEC. 6. *Assessment of cost upon property benefited.*—The assessors of each town through which the road so constructed or improved extends shall, one year after the completion of such road, assess the amount to be paid by the property-owners of the benefit district upon the parcels of land and personal property therein in proportion to the benefits conferred by such construction or improvement. They shall describe in the annual assessment roll, in a place separate from other assessments, the several parcels of land so assessed, and set down the name of the owner of such parcel, when known, with the amount in dollars and cents assessed on each parcel. Such assessment shall be a part of the annual assessment roll, and shall be subject to review and correction in the same manner as the annual assessment roll, and the sums assessed on the several parcels of land shall be liens thereon, respectively, until paid, and shall be collected in the same manner as other town taxes, except that each assessment may be paid in ten equal annual installments, with interest annually at the rate of 5 per cent on the amount unpaid, or in one installment, at the option of the owner of the property assessed; but the owner may, at any time, pay the entire amount unpaid with interest to the date of payment. The amount remaining unpaid upon each assessment shall each year be added in like manner to the assessment roll. All moneys collected upon such assessment shall be paid to the county treasurer and held by him as a separate fund for the payment of all claims arising from the construction or improvement of such road.

SEC. 7. *Issue of bonds.*—The board of supervisors of any county may borrow money, from time to time, for the construction and maintenance of roads built under this act, and may issue bonds or other evidences of indebtedness of the county therefor, which shall be under the official seal of the county treasurer and signed by the chairman of the board of supervisors. Such bonds or other evidences of indebtedness shall bear a rate of interest not exceeding 5 per cent per annum, shall not be for a longer period than fifty years, nor be sold for less than par. But the amount of such bonds or evidences of indebtedness issued by any county for the purposes of this act shall not exceed 3 per cent of the assessed valuation of the real and personal estate subject to taxation in such county.

SEC. 8. This act shall take effect immediately.

U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF ROAD INQUIRY.

HIGHWAY TAXATION: COMPARATIVE RESULTS OF LABOR AND MONEY SYSTEMS.

WASHINGTON, D. C., November 9, 1894.

The appended extracts from letters written in April and May, 1894, convey valuable information from the towns* in the State of New York which have experimented with the money system of taxation in place of the ancient labor system. In that State each town has the option to change from one system to the other at its pleasure. Of the twenty-five towns which have reported upon the change, only one reports unfavorably.

I respectfully recommend the publication of these extracts in the form of a circular.

ROY STONE,

Special Agent and Engineer.

Approved:

J. STERLING MORTON,

Secretary.

NORTH CASTLE, WESTCHESTER COUNTY, N. Y.

The town of North Castle changed its system of working highways about four years ago from the labor tax to the money system, and thus far it has proved to be decidedly the best for us, as the money so raised has been judiciously expended.

The towns of New Castle and Bedford, adjoining us, have both adopted the money system, and as far as I can learn it is very satisfactory.

CHAS. McDONALD, *Town Clerk.*

PELHAM, WESTCHESTER COUNTY, N. Y.

In reference to the change from the labor tax to the money system, I would say that I prefer the latter, not only for the sake of economy, but also for the sake of having better roads; for I think where there are road commissioners elected who understand their business, and are given a certain sum of money to be used in repairing the roads, that the said roads will be put in better repair than they would be if they were repaired under the old system. Under the old system in some cases it is simply a question of putting in the allotted time without any view of improving the road.

J. ALFRED FORDHAM, *Town Clerk.*

*In the State of New York the "Town" is the district usually known as a township in other States.

NORTH SALEM, WESTCHESTER COUNTY, N. Y.

The town of North Salem changed its system of working roads in 1881. We have worked the roads by tax ever since, and we all like it very much. We have better roads, because they are worked up in the proper season. There are at present a number of towns in Westchester County working their roads by the tax system.

I am advised that the towns of New Castle, North Castle, White Plains, New Rochelle, Mamaroneck, and Rye are doing so, and I have no doubt that after a trial they would not care to change back to the old system.

[Signed] TOWN CLERK.

HARRISON, WESTCHESTER COUNTY, N. Y.

It is the opinion of the people in our town that money or tax system of working the roads is by far the best; that the roads have better attention, etc. I have looked into this matter somewhat, and am of the opinion that it is by far the best method.

The towns of Rye, White Plains, Mamaroneck, and New Rochelle all work their roads by the tax system.

EBENEZER BULL, *Town Clerk.*

NEW UTRECHT, KINGS COUNTY, N. Y.

We have made no recent change in our road system. Years ago we changed from the old way of citizens doing work on the roads.

By an act of the legislature in this State \$4,000 are raised each year for the repairing of our roads. The highway commissioners have charge and let contracts for the work done.

JACOB C. MOORE, *Town Clerk.*

POUGHKEEPSIE, DUTCHESS COUNTY, N. Y.

The town of Wappinger voted on the money system March 6, 1894, and rejected it.

The towns of La Grange, Poughkeepsie, and Fishkill are now working under the money system. It is very satisfactory to Poughkeepsie.

G. W. CORNELL, *Town Clerk.*

LA GRANGE, DUTCHESS COUNTY, N. Y.

We are about entering upon the second year of working roads by tax levied upon taxpayers instead of the old system. Under the new system I think we can get better roads, properly managed; but the present State highway laws give the commissioners too much power, thereby running heavy bills, that could in a measure be avoided. I believe the new method is an improvement upon the old way.

Several towns in this county are using the money system, viz: Union Vale, Washington, Beekman, and perhaps a majority of the towns are coming into line.

EUGENE R. SCHRYVER, *Town Clerk.*

RYE, WESTCHESTER COUNTY, N. Y.

This town has adopted the money system for road taxes in place of the labor tax, and find the benefits derived from the change to be greater than those received from the old method of pathmasters.

We receive more for the money raised in this way, because it is judiciously expended under the supervision of the commissioners of highways.

JOHN C. CALPIN, *Town Clerk.*

STANFORD, DUTCHESS COUNTY, N. Y.

I think it is a much-needed change to work the roads by tax instead of the old way. Not only do we have better roads, but I think it is a much cheaper way, as the tax is so low no one feels it.

The towns of Pleasant Valley and Washington work their roads by tax.

A. C. SMITH, *Town Clerk.*

WESTCHESTER, WESTCHESTER COUNTY, N. Y.

Permit me to say that the money system in relation to roads has always obtained in this town.

Besides three commissioners of highways, one of whom is annually elected to the office for a term of three years, we have in this town, at present, an improvement commission (five commissioners) created about five years ago by special legislation, and \$10,000 for highway purposes is annually collected by direct taxation and handled by the improvement commission.

GEORGE J. DUNNIGAN, *Town Clerk.*

CORTLANDT, WESTCHESTER COUNTY, N. Y.

The roads here have been worked on the money system for the past four years, and it is found to be by far the very best system. The roads show a decided improvement over the old system of day labor.

The town of Ossining, I think, works under the money system.

S. ALLEN MEAD, *Town Clerk.*

BEDFORD, WESTCHESTER COUNTY, N. Y.

We have adopted the money system of working roads and we have very much better roads than under the old system of working them. If we could only let out the contracts for more than one year, it would help out very much. Then the contractor would feel a great deal more interest in his road, knowing he could have the benefit of his labor and care for the next year. As it is now, they seem to do as little as they can and get their pay. I think, also, they ought to be compelled to work the roads as early in the spring as they can, and not put off the road work until they get all their farm work done.

W. B. ADAMS, *Town Clerk.*

WASHINGTON, DUTCHESS COUNTY, N. Y.

The roads are much better in every way under the money system and give satisfaction.

The town of Sanford, Dutchess County, works its roads by this method also.

CHARLES KELLEY, *Town Clerk.*

NEW ROCHELLE, WESTCHESTER COUNTY, N. Y.

The system for working roads by tax was adopted about twenty years ago. It is impossible for me to give you any other information.

HUMER E. ELDWHER, *Town Clerk.*

AMENIA, DUTCHESS COUNTY, N. Y.

This town has adopted the money system for road taxes in place of labor tax, and I can say that I do not think there is anyone in the town who would vote the roads worked the old way. We have much better roads worked on the money system.

The town of North East has adopted the money system, I believe.

H. J. EGGLESTON, *Town Clerk.*

NORTHFIELD, RICHMOND COUNTY, N. Y.

In this town, outside of the village of Port Richmond, they bond the town for the roads, and also collect road taxes.

Personally I think this course is not right, but it has always been the custom and they can not change this year, but doubtless will next year.

H. J. SHARRETT, *Town Clerk.*

HUNTINGTON, SUFFOLK COUNTY, N. Y.

In answer to your inquiry in reference to working the highways in this town by money or contract system, will say that if properly managed, it is much better than the old way by labor tax, so far as it has been tried in this town.

PHILLIP PEARSALL, *Town Clerk.*

WALTON, DELAWARE COUNTY, N. Y.

Our town voted at the annual town meeting in 1889 to change from the labor system to the money system of working roads.

From what I can learn, it is generally conceded to be a great improvement over the old way, though of course there are some who oppose it, and a vote was taken in 1893 to ascertain if the town should return to the old way, which resulted in a good majority in favor of the money system.

JOHN S. EELS, *Town Clerk.*

OSSINING, WESTCHESTER COUNTY, N. Y.

I take great pleasure in informing you that this town adopted the money system of working the roads several years ago. Even those who were at first opposed to it now admit the system is an unqualified success. Some, however, think that the work should be let out by contract instead of being done under the supervision of the highway commissioners.

The town of Cortlandt I believe, has tried the same system with the same gratifying result.

ROBERT T. DENNIS, *Town Clerk.*

MOUNT PLEASANT, WESTCHESTER COUNTY, N. Y.

Our town has the money system for road taxes, and the system is more perfect than the labor-tax system. It gives the commissioners more power. They can do more work, on the whole, and I can say it is a great benefit.

The towns of Greensbury and Ossining work under the money system.

MILLARD M. DEWITT, *Town Clerk.*

SMYRNA, CHENANGO COUNTY, N. Y.

This town has been working its roads with the money system for three years and we find we have very much better roads, take it all over the town; for before there were some hill roads that did not receive attention, for there were so few people living on them that they could not work them as they ought to be. Now the commissioners go over the roads and lay out the work where it is needed the most.

E. L. KING, *Town Clerk.*

CANAAN, COLUMBIA COUNTY, N. Y.

We adopted the money system about seven years ago. I think it has resulted in improving the roads to a certain extent, but the farmers seem to be greatly opposed to it, except such as live in the high hills or on sections where there were but few under the labor system to work long stretches of road.

It has cost more by considerable to repair the highways under the money system, I think.

With the law properly framed and enforced, I think the money system would be desirable.

ASHLEY B. HARNES, *Town Clerk.*

GRAVESEND, KINGS COUNTY, N. Y.

The roads in this town are kept in order from income money paid by the town. I think it is much better than the labor tax.

JOHN L. VONHEIS, *Town Clerk.*

GREENBURG, WESTCHESTER COUNTY, N. Y.

The town of Greenburg has been working its roads by the money received by tax for that purpose for a number of years past. I believe that all the towns composing the county of Westchester are working under the same system. In fact, I do not think it possible to do the work in any other manner. Under the old system of labor tax it was the habit of those called upon to work the roads to furnish the poorest kind of labor and material. Under the present system we have the best that can be procured.

As to the present condition of our roads, I might say that they are not at all satisfactory, but are in much better condition than possible under the old system.

K. H. PURDY, *Town Clerk.*

FLATLANDS, KINGS COUNTY, N. Y.

When I first came to reside at Canarsie, in the town of Flatlands, in 1865, we had the labor system for roads. Sometime later that was changed to the direct-tax system. The change is for the worse, I think. There is not a town in Kings County or on Long Island which has as bad roads as we have here.

I do not know of any other town having made the change.

JAMES SAVAGE, *Town Clerk.*

CIRCULAR NO. 17.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

ORIGIN AND WORK OF THE DARLINGTON ROAD LEAGUE.

Harford County, Maryland, is situated in the extreme northeastern part of the State on the western bank of the Susquehanna River. It is a good rich farming country, but it has been noted for the deplorable



FIG. 1.—Road near Darlington, Md., without the jurisdiction of the Road League.

condition of its highways. Maryland as a State has no roads to boast of, and Harford County seemed particularly deficient in this respect.

Although highway legislation in Maryland has long been a mooted question before the Legislature, that body has always adjourned without enacting any practical special road laws. The maintenance and

improvement of the highways are provided for out of the general taxation fund, a sum being set aside for that purpose. Each election district constitutes a road district, and the county commissioners appoint annually a supervisor for each district. Upon the recommendation of such supervisor the commissioners issue road warrants for the repair of specified portions of road. This system of road improvement has not proved a success, as can be seen by the generally poor condition of the highways.

For a long time the people of Harford County endeavored to devise some plan looking to the improvement of the roads. Public meetings were held in almost every town in the county and schemes innumerable were suggested. Among others, an effort was made to have a county engineer appointed, who should supervise and repair the roads, but this, with all other endeavors, failed, and the farmers continued to plod through the mud to market.

Among the numerous small towns in Harford County is the village of Darlington, a place of about two hundred people located in the northeastern part of the county. The roads in the immediate vicinity of Darlington were probably the worst in that county. Its nearest railroad station is four miles away, and this made its citizens feel all the more keenly the need of better roads. Urged on by this constant and growing evil, a few of the leading citizens issued a public call for a meeting. This was in the fall of 1887. About fifty men responded. After some discussion, the following resolution was adopted by the meeting:

We the undersigned, citizens of Harford County, Maryland, realizing the importance of taking some more active measures looking to the improvement of our public highways in and around the town of Darlington, call upon our fellow-citizens to join us in forming an organization to be known as the Road League, which shall have for its object the maintenance and improvement of the roads in Darlington and vicinity.

We expect to render aid to our county commissioners and road supervisors, recognizing as we do their efficiency and liberality in the past. We believe that by a united effort on the part of our citizens, acting in concert, and setting aside all selfish interests and all political conditions, we can thus secure the greatest good to the greatest number.

With the most improved implements and machinery always at our command and a competent and skillful overseer to direct the work at a seasonable time and in a systematic manner, we feel sure of having better results than ever before.

The business of this road league and the direction of its affairs should be intrusted to a council of twelve of our tried and trusted citizens, who shall hold office for one year or until their successors are elected on the second Wednesday in October of each year. Their first duties shall be to elect officers for the association and formulate a plan for practical work.

Any person may become a member by paying the sum of one dollar annually, and we earnestly hope for a widely extended membership, so that our hands may be strengthened and a healthy public spirit may be fostered and encouraged in our midst.

This resolution was signed by forty-five citizens, and out of it sprang the Darlington Road League. A constitution and by-laws were adopted which provided for the management of the affairs of the league by a council of twelve. This council of twelve was the working force of the organization. They held many meetings, at which they received full reports of the work of the overseer and members of the league. They proceeded upon the theory that in order to insure success in road improvement the work must begin at home among the people.

To this end they called upon the county commissioners, requesting them to intrust the repair of the roads in Darlington, about two miles in extent, to the care of the Road League. This the commissioners



FIG. 2.—Road leading out of Darlington, Md., after improvement.

did, granting at the same time that portion of the road fund set aside for the use of Darlington's roads. The league went to work in earnest, and in less than thirty days they had constructed two miles of good shell road, running the entire length of the town.

Encouraged by the success of their first efforts, and with a desire to increase their usefulness and extend their dominion, the council of twelve again called upon the county commissioners. This time they asked to be intrusted with a greater extent of territory, and also that they be allowed a special appropriation from the county. Both requests were promptly granted. The league then went about soliciting sub-

scriptions among its members, and in a short time they had an amount greater than the county's appropriation. This gave them a nice working capital, and with the aid of a road machine, donated by one of its enthusiastic members, the league was soon in good working order.

One of the first acts was to appoint an overseer of its own. To him was intrusted the care of the entire territory under the supervision of the league and the appointment of sub-supervisors.

During the first year of the league's existence \$350 in road warrants, \$500 special appropriation from the county, and about \$800 raised by private subscription, constituted the working fund of the league. With this money they managed to construct some entirely new roads, and to improve and keep in repair almost fifteen miles of roadway, and at the same time reserve a balance of \$400.

In 1889 the county commissioners, impressed with the good work being done by the Darlington League, offered it the care of as many miles of road as it could work but the league concluded it could not do justice, with its limited membership, to a greater extent than it already possessed, some fifteen miles. This year the road warrants amounted to some \$515, and an additional appropriation of \$500 was made by the county. With this money they repaired about sixteen miles of road, besides doing considerable piking within the town limits.

Each successive year the amount of money used grew less, until now the league depends entirely upon the usual amount of cash given them in the shape of road warrants. They have the roads in such good shape that very little money suffices to keep them in repair.

In 1893 the league offered cash prizes, "with a view of encouraging and securing a better standard of road improvement throughout the district," to the sub-supervisors who should accomplish the best results with the relatively least expenditure of money. This did much toward stimulating interest in the work of the organization.

Individual work was also a feature which contributed to the success of the enterprise. Farmers throughout the district volunteered their services in hauling shells, cinders, etc., and in working upon the roads themselves.

It is now proposed to purchase a stone crusher, with a view of utilizing the great amount of stone that is found in the county. It is the hope of many members of the league that in the course of a few years the Darlington League can boast of having a good system of macadamized roads. At present the roads are constructed of cinders and oyster shells. The cinders combined with the clay form a very good roadbed, but it is not lasting, and it is necessary to keep at work repairing.

It has been suggested as a further incentive to road improvement, that the youths of the district become interested in the good work, and

to this end it is proposed to organize a league composed entirely of boys, to be operated under the supervision of the parent league. This it is claimed will engender a desire for good roads on the part of the boys which will cling to them when they grow to be men.

"The work and success of our league," said the president, "go to show that the way to get good roads is to begin the work at home, at the very threshold. It is impossible to undertake road improvement upon a great scale with any assurance of success. It must be done by beginning in a small way and gradually extending the work. It is the combination of small things which go to make up great powers. So it is with road improvement. We should organize into small clubs and leagues at first, and then combine.



FIG. 3.—Road in Darlington, Md., within Road League's jurisdiction.

"It is our desire to have many similar organizations formed throughout Maryland, and then to establish a State league. This can be done if only the other counties will follow our example."

That the Darlington Road League has done good work can be seen by the growing interest, which has led to the formation of other associations in the county, and a glance at the accompanying illustrations will show the difference between roads improved under the direction of the league and those without its jurisdiction.

The officers of the Darlington League are :

President, D. C. Wharton Smith.

Secretary and Treasurer, C. Wilson.

The constitution and by-laws of the Darlington Road League are appended.

Approved :

J. STERLING MORTON,

Secretary.

ROY STONE,

Special Agent and Engineer.

WASHINGTON, D. C., September 25, 1895.

CONSTITUTION.

ARTICLE 1.—This organization shall be known as the Darlington Road League of Harford County, Maryland.

ART. 2.—Its object shall be the improvement of public roads in Darlington and vicinity.

ART. 3.—Any person may become a member on payment of one dollar per annum, and shall be entitled to vote at annual meetings.

ART. 4.—The annual meeting shall be held in November on Mondays on or preceding the full moon.

ART. 5.—The business of the Road League shall be intrusted to a council of twelve, who shall be chosen by ballot at the annual meetings, and they shall hold office until their successors are elected.

BY-LAWS.

ARTICLE. 1.—The council of twelve shall convene as soon as possible after the election, and shall choose from their number a president, also a secretary and treasurer (who may be one and the same person), and the council shall hold meetings monthly at the call of the secretary.

ART. 2.—The president shall preside at all meetings, and when absent a member present shall be called to the chair in the usual way.

ART. 3.—The secretary shall keep a record of the proceedings of all meetings and conduct the correspondence of the league.

ART. 4.—The treasurer shall keep an accurate account of receipts and disbursements in a book for that purpose, and all disbursements shall be authorized or approved by the council.

ART. 5.—Meetings of the council may be called by order of the president, or at the request of three of its members, and five shall constitute a quorum.

ART. 6.—The president shall appoint a monthly committee of two members of the council, who shall give special supervision to the work of the overseer in charge of the roads under the jurisdiction of the league, and serve until their successors are appointed.

ART. 7.—The council shall fill all vacancies occurring by resignation or otherwise, and they may drop from their number any member who shall persistently neglect his duty, or manifest indifference by nonattendance of the monthly meetings.

ART. 8.—The constitution and by-laws of this league may be changed by a two-thirds vote of the entire council, notice of such change having been given in writing at a preceding meeting.

The order of business of the council shall be as follows :

1. Roll call.
2. Reading of minutes of previous meeting.
3. Report of treasurer.
4. Unfinished business.
5. New business.
6. Reports of committees and of the overseers.
7. Adjournment.

CIRCULAR NO. 18.

United States Department of Agriculture,
OFFICE OF ROAD INQUIRY.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

SIR:

The scheme of legislation unanimously adopted by the recent road convention in Richmond, Va., contains so much of valuable suggestion that I would respectfully recommend its publication as a circular of this office for the benefit of other States which are seeking methods to improve their highways.

Very respectfully,

ROY STONE,
Special Agent and Engineer.

APPROVED:

J. STERLING MORTON,
Secretary.

REPORT OF COMMITTEE ON LEGISLATION,

ADOPTED BY THE STATE GOOD ROADS CONVENTION, HELD IN RICHMOND,
VA., OCTOBER 10 AND 11, 1895.

Whereas it is expedient, right, and proper that this Convention, composed of representatives of all classes, interests, and sections assembled for the purpose of discussing the road question, should make a clear declaration of its principles upon the important subject of road legislation: Therefore, *be it resolved*,

1. That we favor the enactment of a law by which all classes and interests in the State shall bear the burden of taxation for road purposes in proportion to the benefits derived; by which State aid will be extended to the improvement to the main roads under equitable conditions; by which the counties will be allowed to issue bonds for the permanent improvement of the public roads under proper conditions and restrictions; by which both State and county convicts, or convicted prisoners, will be employed in improving the public roads; by which the road work will be placed under the control of the Boards of Supervisors, or of Special Road Boards of the respective counties, and by which the actual supervision of the road work will be intrusted to county engineers, thus consolidating the authority and responsibility, and insuring intelligent supervision. That to this end, we would urge the enactment of a general law containing the following provisions:

A State tax of 5 cents on \$100 valuation of all real and personal property subject to taxation by the State, the revenue derived therefrom to be known as a "State Road Fund."

*

The Board of Supervisors of each county shall appropriate out of the county levy each year an amount equal to at least 5 cents on the \$100 of real and personal property for the maintenance and improvement of the roads.

Authorizing the Boards of Supervisors, at their discretion, to apply revenues derived from railroads, or any other special revenues, to road improvement.

Authorizing the counties to issue bonds for the permanent improvement of the public roads upon a vote of three-fifths of the freeholders of the county: *Provided*, That the total indebtedness of any county shall not exceed 15 per cent of the assessed values of the county, and that such bonds shall bear interest at a rate not exceeding 6 per cent per annum, and be sold for not less than par.

Providing for the working of the State and county convicts, or convicted criminals, in preparing material for the permanent improvement of the public roads, such material to be supplied to the counties at actual cost.

Allowing a county or city to hire its convicted criminals to another county under proper conditions, to be worked on the roads.

Providing for the appointment of a State Highway Commissioner by the Governor, by and with the consent of the Senate, for a term of four years, whose duty it shall be to supervise the application of the State Road Fund, distribute road literature and information, collect data to be published in Annual Reports for the use of those engaged in road work and for the information of the legislature, and to do anything in his power to aid in the permanent improvement of the roads.

Placing the roads in charge of the Boards of Supervisors or Special Road Boards in the respective counties.

Amending the present laws in regard to graduates in engineering educated at the State expense, so that such graduates may serve as county engineers for two years, when employed by the Boards of Supervisors, instead of teaching two years.

Providing for State aid to permanent improvement of the highways on the following general plan:

On petition of the owners of one-third of the lands bordering upon any section of road, asking for a survey of such section of road and estimate of the cost of permanently improving same with either stone, gravel, or shells, accompanied by a description of the land which, in their opinion, would be directly benefited by such improvement, the Board of Supervisors shall forward copy of such petition to the State Highway Commissioner, and direct the County Engineer to make such survey and submit an estimate of the cost of such improvement, together with a plat of that section of the road to be improved, and the lands described in the petition which would be directly benefited by such improvement. Whenever thereafter, the owners of three-fifths of the lands in such benefit district shall make application in writing to have such improvement made, and one-tenth of the cost of same assessed against the real and personal property in such benefit district in proportion to the benefits conferred by such improvements, such application, together with copies of the plats and estimate and all papers pertaining thereto, shall be forwarded to the State Highway Commissioner, who shall examine into the case, and if he finds that the road to be improved is a main road, and approves of the improvement and the plan upon which the work is to be done, he shall allow State aid therefor. The work shall then be done on plans and specifications prepared by the County Engineer and approved by the State Highway Commissioner, and under the direct supervision of a Superintendent appointed by the State Highway Commissioner, such Superintendent to be subordinate to the County Engineer, and the work may be done by contract or otherwise. The Board of Supervisors shall arrange for the payment of the entire cost

of such improvement out of the County Treasury upon certificate of the County Engineer that the work has been properly done, and when such work is completed to the satisfaction of the County Engineer, one-tenth of the total cost thereof shall be assessed against the real and personal property in the benefit district in proportion to the benefits derived, such assessments to be made by a board of assessors to be appointed by the County Court of each county, and such property-holders being given five years or such portion thereof as may be desired to pay such assessments, the deferred payments to bear interest at 5 per cent per annum; and the Board of Supervisors shall also forward to the State Highway Commissioner the Engineer's certificate of the completion of the work, together with a detailed account of the cost thereof. The Highway Commissioner shall then authorize the State Treasurer to pay out of the State Road Fund to the Treasurer of the county in which the improvement is located, one-fourth of the total cost of such improvement: *Provided*, That no county shall receive in any one year more than $2\frac{1}{2}$ per cent of the entire State Fund, until all counties have had an opportunity of applying. Such road shall remain under the control of the county and be maintained at its expense. If the permanent improvement of a road would be of special benefit to the people of any county, while on account of local conditions the assessment of any proportion of the cost of such improvement against the adjoining property would be impracticable, State aid may be given to the improvement of such road to the extent of 25 per cent of the cost of such improvement and the balance of such cost may be paid entirely by the county.

2. That the President of this Convention be authorized to appoint a committee of ten, one from each Congressional district, to prepare a bill in accordance with the above resolution, to be presented at once to the Governor and to the Legislature of Virginia as soon as possible after it convenes in December, and urge the passage thereof.

EXPLANATION.

A brief explanation of the provisions recommended in this report may lead to a more thorough understanding of the purpose of such a law and what would be its effects.

The first section is simply a declaration of the principles upon which the provisions that follow are based, and will, therefore, be explained in noticing the provisions themselves.

The plan of taxation proposed in sections 2, 3, and 4 is in accordance with the principle that "all interests in the State shall bear the burden of taxation for road purposes in proportion to the benefits derived," upon which principle all taxation should be based. The farmer would derive the greatest benefits from good roads because he uses the roads most, but the cities, railroads, and all interests would derive great direct and indirect benefits, and should bear some of the expense of making the improvement. These interests can not be taxed without taxing the farmer also; hence a general State tax is necessary. The tax proposed will provide a "State Road Fund" of about \$231,000, of which \$117,000 will be paid by the cities, towns, railroads, and banks, and \$114,000 will be paid by the counties. In addition to this the counties are authorized to levy a county tax of 5 cents on \$100 minimum, to be increased at *their discretion*, and to apply special revenues to the improvement of the roads. This leaves the question of county taxation in the hands of the county authorities just as it is under the present laws. The present law fixes the minimum county tax for road purposes at 5 cents on the \$100, and this tax now ranges from 5 cents to 50 cents on the \$100, in the different counties, averaging about 20 cents on \$100. Although the plan proposed provides for a more just distribution of the burden of taxation, it

does *not necessarily increase taxation* except in the cities and those few counties which now have a very small road tax; for the regulation of the county tax rate above the low minimum of 5 cents on \$100 is left entirely in the hands of the county authorities.

The fifth section authorizes the counties to issue bonds to provide means for improving the highways. It should be noticed that the counties are not *required* to issue bonds, but simply given the privilege of doing so on vote of *three-fifths* of the freeholders of a county. This leaves the matter entirely in the hands of the taxpayers of a county, and is eminently a just provision; for if there is only one county in the State which desired to issue bonds, there is no reason why it should be restrained from doing so because the other ninety-nine did not desire to make such an issue. Proper safeguards are provided in limiting the debt to 15 per cent of the assessed values of a county, and limiting the rate of interest to 6 per cent; and the county credit is protected by not allowing a sale of bonds below par value. Of course a law when drawn will provide the details as to the manner of issuing bonds and payment of the debt.

The sixth and seventh sections provide for improving the roads with the labor of both State and county convicts which may be available for this purpose. It provides for working these convicts in a manner which will render the convict self-supporting; will avoid the objectionable feature of having them come in contact with the people; will aid the permanent improvement of roads, which is the object desired; and by a system which has been proven by the experience of other States to be the most economical and advantageous method of working this labor. But any county or city that does not use it can make its convicted criminals self-supporting by hiring them to counties that do use this class of labor. It does not provide for the cancellation of any existing arrangements, but simply for the working of such convicts as may be available.

The eighth section provides for the appointment of a State Highway Commissioner. It should be noted that this officer is not only required to supervise the application of the State Road Fund, but he is also required to distribute literature, collect data, and keep the people informed as to the best methods of road work. The distribution of \$231,000, allowing only 2½ per cent of such sum to any one county, will, of itself, require a man of ability and judgment, but when the other duties are added, the position becomes one of greatest importance to the State, and of heavy responsibility. This officer is necessary to properly direct the expenditure of this State Road Fund. It should be remembered that more than one-half of this fund is provided by interests which would only be benefited by permanent improvement of the roads, and they would not be willing to be taxed, nor would it be just to tax them, if the revenues derived from such taxation were distributed indiscriminately among the counties, and wasted in mending or repairing roads from which these interests would derive no benefit. As the largest contributors to this fund, they have a right to have some say in its expenditure through a special commissioner who would represent and harmonize all interests, as well as see that this fund was so expended as to produce permanent benefits. A system of highway improvement would thus be inaugurated, which would be impossible, except with a State officer in charge of this fund. Such an office is being provided by all States which are making much progress in road improvement.

The ninth section places the road work in the hands of the Board of Supervisors of a county or of a special Road Board if the county should prefer to have such a Board. This is obviously proper and needs no explanation.

The tenth section refers to that clause of section 1 which demands that the actual supervision of the road work be intrusted to county engineers. The

experience of this and other States proves that such consolidated authority and intelligent supervision is necessary in order to secure the best results from money expended. Over \$15,000,000 has been expended on the public roads of Virginia since the war, and the roads have grown worse instead of better, because this money has been wasted for want of intelligent supervision, or paid out to the numerous road officers who have been and are still employed in most counties. Where the revenue of one county will not justify the employment of an engineer, two, or even more, can unite to employ one engineer; but this is a detail which will be provided for in preparing the law. If engineers are employed there is no reason why the State students graduating in engineering should not be allowed to do this work if they are wanted by the Boards of Supervisors. This is left entirely to these Boards, and if they prefer an experienced man they can employ him.

The eleventh section provides a general plan by which the State Road Fund may be expended in aiding the permanent improvement of the main highways. This plan is based upon the eminently just principle already announced, that every interest should be taxed for road improvement in proportion to the benefits which would be derived from such improvement. The people of the whole State are benefited by the *permanent* improvement of any main highway by the increase in land values which would result, as well as the effect upon the general welfare; hence the State pays 25 per cent of the cost of such permanent improvements. The people of a county are benefited more directly and to a much greater extent than the people of the whole State, by the permanent improvement of any main road in the county, hence the county pays 65 per cent; and the people living along such road who have to travel it derive much greater benefits from the improvement than any one else, hence they pay 10 per cent of the cost of the work in addition to their proportion of the State and county contributions. This 10 per cent is, however, assessed against the property-holders directly benefited in proportion to the benefits derived, thus carrying out to the minutest detail the principle of taxation enunciated. It should be considered that neither the State nor county has any authority to make such assessments except on *petition* of the owners of *three-fifths* of the land in such benefit district. These land-owners are given five years in which to pay such assessments, and experience everywhere has proven that in this time the benefits derived from such improvement will have paid the tax many times over. The plan upon which the work is to be done is simple and in accordance with recognized business methods. The first step is to have a survey made and an estimate of the cost of the work prepared. The land-owners can then see just what the assessment against them will be, and if the owners of three-fifths of such land *are willing to pay such assessments* they *petition* to have the work done. The papers are then forwarded to the Highway Commissioner, and if he finds that the improvement is one that would justify State aid, he signifies the willingness of the State to pay its proportion, and the county, since it has the largest interest at stake, very properly arranges to have the work done. The work is done under the supervision of a competent engineer and on clearly prescribed plans and specifications, thus obviating the reckless waste due to ignorance and lack of system, which has been the curse of our road work. The County Engineer, having all the roads to look after, can not be present all the time; hence there must be some one in immediate charge of the work. In order that the State's interest may be properly protected, this direct supervision is intrusted to a Superintendent appointed by the Highway Commissioner, but subordinate to the County Engineer. When the work is completed the engineer gives his certificate to that effect, and upon this certificate, accompanied by a detailed

statement of the cost, the State pays 25 per cent of such cost to the county ; 10 per cent is assessed against the property directly benefited by a board of assessors, and the county settles with the contractor or party doing the work. There are some roads in the State running through tracts of waste land, where it would be impracticable to make any assessment against adjoining property, though it would be necessary for the people of a large section to use the road constantly. In order to provide for the improvement of such roads, the last sentence of this section provides that State aid may be granted to such improvement to the extent of 25 per cent of the cost, if the county will assume the additional 10 per cent which under other circumstances would be assessed against adjoining property ; thus, in such exceptional cases, the State would pay 25 per cent and the county 75 per cent.

It will be seen, then, that the plan proposed is just, being founded upon the true principle of taxation ; that it does not *necessarily increase taxation* in the counties, but gives them the benefit of an additional revenue for permanent improvements ; that it provides an equitable and economical method of working State and county convicts on roads ; that it provides for consolidated authority and intelligent supervision ; that it maintains the principle of home rule by leaving rate of taxation to be regulated by the counties, and by leaving the questions of issuing bonds, working convicts, and making permanent improvements absolutely in their hands. It will be economical for the reason that it does away with about five hundred road officers who know nothing about the science of road building, and substitutes for them about seventy-five (in a number of cases two counties will employ one engineer) who understand the work of making roads, and would save the money now wasted. In considering this plan, the following facts should be borne in mind :

It is not the intention to make a complete system of roads at once, but to begin a system of permanent improvements that may be gradually enlarged.

We have wasted about \$15,000,000 in mud holes since the war, and it is quite time to stop this waste. The proposed plan simply provides a way for the counties to begin laying aside a portion of their revenue in permanent improvements, but *leaves it entirely to them* whether they will do so or not.

While the necessity for improved road methods is admitted, no other plan is suggested.

Many conflicting interests and opinions have to be harmonized.

Without the State aid plan, the counties bear the entire burden while the cities and railroads derive much benefit.

This plan is the result of a careful study of a mass of data as to road conditions and road laws, collected by the State Association during the past year.

This plan has been tried in other States, and has been a complete success everywhere.

It is by far the most successful method of improving the roads now in effect in this country, and is no experiment.

[The following are the officers of the Virginia State Good Roads Association : Joseph Bryan, president, Richmond ; Chas. E. Ashburner, Jr., first vice-president, Brook Hill ; H. W. Anderson, secretary and treasurer, Richmond.]

WASHINGTON, D. C., October 29, 1895.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., April 4, 1896.

SIR: The information transmitted herewith completes an interesting investigation relating to the traffic of the country roads in the United States, and I recommend that it be published as a circular of this office.

Respectfully,

Hon. J. STERLING MORTON,
Secretary of Agriculture.

ROY STONE,
Special Agent and Engineer.

TRAFFIC OF THE COUNTRY ROADS.

Ten thousand letters of inquiry were, with the aid of the Division of Statistics of the Department, sent to intelligent and reliable farmers throughout the country, and reports have now been consolidated from about 1,200 counties giving the average length of haul, in miles, from farms to market or shipping points, the average weight of load hauled, and the average cost per ton per mile; and from these data is deduced the average cost per ton for the whole length of haul.

These returns have been arranged in groups of States, and the result shows that the average length of haul in the Eastern States is 5.9 miles; in the Northern States, 6.9 miles; in the Middle States, 8.8 miles; in the cotton States, 12.6 miles; in the Prairie States, 8.8 miles; in the Pacific Coast and mountain States, 23.3 miles; and in the whole United States, 12.1 miles.

The average weight of load for two horses in the Eastern States is 2,216 pounds; cotton States, 1,397 pounds; prairie States, 2,409 pounds; Pacific Coast and mountain States, 2,197 pounds; and the whole United States, 2,002 pounds.

The average cost per ton of 2,000 pounds per mile in the Eastern States is 32 cents; Northern States, 27 cents; Middle-Southern States, 31 cents; cotton States, 25 cents; prairie States, 22 cents; Pacific Coast and mountain States, 22 cents; and the whole United States, 25 cents.

The average total cost per ton for the whole length of haul is as follows: Eastern States, \$1.89; Northern States, \$1.86; Middle-Southern States, \$2.72; cotton States, \$3.05; prairie States, \$1.94; Pacific Coast and mountain States, \$5.12; and the whole United States, \$3.02.

Assuming the correctness of these data it becomes possible to obtain approximately the total cost of the entire movement of farm products and other classes of materials over country roads.

There is of course a liability to error in averaging the total cost per ton for the length of haul in the whole country in this manner, and possibly a more accurate average could be attained by taking into account the actual quantities of farm products and all other supplies hauled in each of the States. This, however, would have required entirely separate investigation in the Pacific Coast and mountain States and in the cotton States, where a vast amount of secondary hauling is carried on, that is, of products which have once been carried to the railroad or water, transported to distributing points, hauled again to local depots, thence again to lumber and mining camps, etc., involving a three-fold movement of the same product. In this case the total amount of road traffic bears very little relation to the actual agricultural productions of the State in question.

The estimate of the California Highway Commission, taking into account all the traffic of the State, runs far above the amount which would be arrived at by the method of computation which is here adopted.

Again, in the cotton States, while the actual marketed product is very light in weight, the supplies necessary to produce that product, and often amounting to very much more than the weight of the product itself, must be carried to the plantations from railroads, rivers, and ports. This movement is decreasing as the plantations approach self-supporting conditions, but it is still very large, and, on the whole, we have thought it not unsafe to carry the one system of computation throughout the whole country.

Taking the census returns of the farm products of the United States for 1890, adding 8 per cent for the increase in five years corresponding to the increase in the previous ten years, finding the weights of the various articles, and reducing the total to tons of 2,000 pounds, we have a total weight of farm products for the year 1895 of 219,824,227 tons.

Comparing the amounts by States, Iowa leads with 24,287,000 tons; Illinois comes next with 21,000,000 tons; Kansas with 17,000,000; Missouri, New York, Ohio, and Nebraska with 12,000,000 to 15,000,000 tons; Indiana and Pennsylvania about 10,000,000 tons; Michigan, Minnesota, and Wisconsin 7,000,000 to 8,000,000 tons; and Texas, Colorado, Kentucky, and Tennessee 4,000,000 to 5,000,000 tons.

No information is available as to the amount of hay and grain consumed upon the farms where they are raised, nor is there any return of large classes of materials moved over the country roads, among which are: Building materials, including stone, lumber, brick, lime, and sand; fencing materials; road materials—gravel, stone, etc.; fertilizers—commercial and domestic, lime, and plaster; coal, ore, and metals; straw and fodder; home-killed meats and animals driven to market; poultry and eggs; merchandise; farm machinery.

It is deemed safe, however, to offset these various items against home-consumed hay and grain, and so count the equivalent of the total farm product as being hauled on the public roads.

The Division of Forestry of the Department furnishes an estimate of forest products as follows:

	Cubic feet.
Annual cut of fuel.....	18,000,000,000
Mill product.	5,000,000,000
Total.....	23,000,000,000

The Chief of the Division of Forestry makes the very safe estimate that one-fourth of this total, or 5,750,000,000 cubic feet is hauled over the public roads. Adding timber used for railroad construction, 485,000,000 cubic feet, makes a total of 6,235,000,000 feet, which, at 30 pounds per cubic foot, gives 93,525,000 tons of 2,000 pounds. Adding this to the total farm product gives 313,349,227 tons, which at the average cost above stated, \$3.02 per ton, makes a grand total for the annual cost of haulage on the public roads of \$946,414,665.54.

The immensity of this charge will be best realized by comparing it with the values of all farm products in the United States for the year 1890—\$2,480,170,454—which values have probably diminished since that date.

What portion of the total cost of haulage is chargeable to bad roads can be better ascertained when the report from our consuls abroad regarding the cost of haulage on good roads is received. This information has been asked for from the State Department by the Secretary of Agriculture in a recent communication.

The increase in cost of haulage actually done is by no means the only loss by bad roads. The loss of perishable products for want of access to market; the failure to reach market when prices are good; and the failure to cultivate products which would be marketable if markets were always accessible—add many millions to the actual tax of bad roads. Moreover, the enforced idleness of millions of men and draft animals during large portions of the year is a loss not always taken into account in estimating the cost of work actually done.

Information already in possession of the Office of Road Inquiry indicates that, all things being considered, nearly, if not quite, two-thirds of this vast expense may be saved by road improvement, and this at a total cost not exceeding the losses of three or, at the most, four years by bad roads.

There is at least enough in these facts to justify the assertion of the National League for Good Roads, indorsed by the Chamber of Commerce of the State of New York, that "the movement for good roads deeply concerns every commercial and financial interest in the land. We are handicapped in all the

markets of the world by an enormous waste of labor in the primary transportation of our products and manufacturers, while our home markets are restricted by difficulties in rural distribution which not infrequently clog all the channels of transportation, trade, and finance.

The good roads in the United States are so few and so scattered that, even where they exist, only a small part of their ultimate benefits can yet be realized, from the fact that to carry a full load on a good road requires a wagon heavy enough to be a load when empty for an ordinary country road in bad weather. Farmers generally, therefore, even though they have a good road for the bulk of their traffic, are not prepared with wagons suited to that road, since the same wagon must do their work on bad roads as well. In a very few sections where nearly all the roads are improved, as, for example, Chester Township Burlington County, New Jersey, wagons are used which weigh empty nearly three thousand pounds; these wagons will carry a load of from six to eight thousand pounds, but, in general, it may be safe to say that the wagons used on the best roads in this country are not adapted to carrying more than two-thirds of a proper load for those roads.

The appended condensed replies to the circular asking for information upon this point will be analyzed and summarized for a future edition of this circular whenever the information expected through the State Department is received, and can be embodied in the work.

OPINIONS OF REPRESENTATIVE MEN.

From A. J. Cassatt, Philadelphia, Pa.: "A ton was about as much as they could formerly haul. Now they carry as much as two tons of hay or straw, and bring back all the manure they can pile on a two-horse wagon."

From Emmor Roberts, Fellowship, N. J.: "We have expected that we could accomplish just about double the work with the stone roads that we did with the gravel turnpikes, and nearly double with the turnpikes in good order that we could with the ordinary country roads."

From W. W. Mitchell, Paris, Ky.: "The average load hauled over our pikes with the horses is 4,000 pounds."

From Clayton Conrow, Burlington County, N. J.: "Before the construction of stone roads in Burlington County, it cost 15 cents per basket to market truck; now it costs 3 cents."

From George Banfield, Johnstown, Pa.: "On our good roads in town two horses will make good time with 4,000 pounds. It will cost 6 cents per bushel on a bad road to haul wheat 10 miles; on a good road it can be hauled for 3 cents per bushel 10 miles."

From E. G. Harrison, of Asbury Park, N. J.: "On the whole the cost of 25 cents per mile per ton might be a fair average, that is, taking the country through, while if we take special sections and special work when teaming is done as a business, the cost would be much lower.

From W. W. Dodge, Manager Transportation Dept., Sprague, Warner & Company, Chicago, Ill.: "The cost per ton per mile is 13 cents."

From N. O. Whitney, Madison, Wis.: "Your average of 25 cents per ton-mile agrees very closely with our best authorities."

From John M. Sutton, Woodbridge, N. J.: "Cost of hauling clay, sand, or kaolin averages 30 cents per mile; manure, hay, and other farm produce, 25 cents per mile. The average weight of loads is about 4,566 pounds. When our hauling was over dirt roads entirely, the average weight of loads was about 3,900 pounds, making a difference of from 500 to 600 pounds."

From John C. Beans, Moorestown, N. J.: "The estimated cost of hauling 2,000 pounds one mile is 7 cents. This is rather ideal and may well be scrutinized in detail."

From Samuel L. Allen, Moorestown, N. J.: "As the team has to return empty, my estimates would mean that two tons would be hauled eighteen miles to market in a day for \$3.50; or just about 10 cents a mile for 2,000 pounds."

From Charles B. Coles, Camden, N. J.: "I think the up-to-date farmers' load twice as heavy now, where they have roads, as they used to be. In our business we cart about 4,500 pounds to a load where roads are good; 2,250 pounds old-style roads. Costs now about 25 cents per ton per mile."

From Amos Ebert, Ashland, N. J.: "We haul about the same loads now with less fatigue with two horses than formerly with three and four, with an average saving of 50 per cent."

From Charles Collins, Moorestown, N. J.: "The stone road being always hard, the actual cost of hauling is less than half that over ordinarily good country roads."

From Dennis C. Crane, Westfield, N. J.: "On our well-graded macadamized roads in Union County our stone carters with two ordinary horses take from 6,000 to 8,000 pounds to a load. The average load of hay and other farm produce carted by farmers is from a third to a half more than they carted before the roads were improved. Stone carters receive about 25 cents a ton for the first mile and 10 cents for each additional mile."

From C. V. W. Fonda, Paterson, N. J.: "The average load hauled is about 2,000 pounds; the average cost prior to building our stone roads was about 30 cents per mile for hauling such load; the cost at the present time over stone roads (macadam) is about 10 cents per mile."

From Robert A. Meeker, Plainfield, N. J.: "The average load hauled by two horses over our streets, as compiled from actual weight, is three and one-half tons. The cost of hauling from the country varies from 17½ cents to 15 cents per ton per mile."

From James J. Davidson, Swedesboro, N. J.: "Costs about one-half as much to cart a ton over our stone roads as it does over the ordinary country road."

From Colin R. Wise, Passaic, N. J.: "Contractors in this vicinity are able to haul from 3,950 to 5,000 pounds of broken stone per load (two horses) from their crushers or from the railroad to new work, over our macadamized roads. In one case, where the contractor has a haul of four miles, with grades favorable to him, he is able to haul his stone at 12½ cents per ton per mile. In another case, when the contractor has a short haul, but has adverse grades, the cost per ton per mile was 18 1-5 cents. The farmers in this vicinity take from 4,000 pounds to 5,500 pounds per load (two horses) of garden truck, or farm produce, or manures, to market or back to the farm at the rate of about 14 7-12 cents."

From L. P. Spurr, Lexington, Ky.: "During the summer months when we haul our wheat, we never put on a team less than 100 bushels. This is easily hauled on our best roads. Were I compelled to pay the average price (25 cents per ton per mile) as reported by you, I would be compelled to close business and leave."

From Chas. K. Van Sciver, Beverly, N. J.: "The average load on our improved roads is about 3,500 pounds, and the average cost of hauling one ton is 15 cents per mile."

From J. S. Rogers, Stanwick, N. J.: "I am free to say we haul more than double the loads on stone roads that we formerly hauled over same roads before they were improved, and with much less wear on the team, and with a great saving of time."

From Ira P. Cribb, Canandaigua, N. Y.: "I find the average cost of hauling 2,000 pounds to be about 16 cents per mile."

From J. J. Albertson, Magnolia, N. J.: "Over our well-graded improved telford roads the average load for two horses, exclusive of wagon, is three tons of manure and about two tons of farm produce."

From Hon. Thomas Whitehead, Richmond, Va.: "Beyond controversy, short hauls on macadam roads with improved wagons would overcome the disadvantage of lack of railroads for 10 or 15 miles. In fact, where the trip to the railroad could be made and return in one day, farmers and lumbermen would have all the advantages the railroad would give them."

From William Haelig, Boundbrook, N. J.: "Where they haul four tons to the load, they use narrow-tire wagons and have the good telford roads cut up already. I, on my roads, use only four-inch-tire wagons and my roads are always in good condition. My roads are common roads covered with a top-dressing of three to four inches of crushed stone."

CIRCULAR No. 20.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

COMMENTS ON SYSTEMS OF MAINTAINING COUNTRY ROADS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., May 1, 1896.

SIR: The information submitted herewith is extracted from a large number of letters, and in the belief that it will excite discussion favorable to the interests of good roads for the country, I recommend its publication as Circular No. 20 of this office.

Respectfully,

ROY STONE,
Special Agent and Engineer.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

A large number of letters was sent out from this office in January making "inquiries regarding the comparative merits of the various systems of repairing and maintaining the country roads, especially as to whether the contract system has been successful in places where it has been tested." The replies received show a variety of opinions, the writers agreeing but in one thing, namely, that the old method of "working" the roads under supervisors is entirely unsatisfactory. What shall take the place of this old method is still a matter of doubt in some places and of experiment in others.

Extracts from several of the replies, written by men who have had experience in road matters, are given herewith with the view to stimulate discussion as to methods and means of repairing country roads, and with the hope that out of the discussion may result a feasible plan for correcting the evils that now so generally prevail with the system of working the roads under the direction of supervisors.

OPINIONS OF CORRESPONDENTS.

From Dr. W. Lawrence Stevenson, New Orleans, La.: "We have in this parish now a contract system of roads. At the beginning of last year we gave out a contract after advertising for bids, by which we pay \$50 per mile for making and maintaining roads for the first year, \$40 for the second year, and \$30 for the third year. The contractor has continually working on the roads two sets of the latest improved road machines. The road is made perfectly round, and the water disappears immediately after each rain. The drummers pronounce our roads the finest in south Louisiana."

From N. F. Underwood, Lake Como, Pa.: "The general law of the State is in brief the township supervisor system, with the right to each taxpayer to work out his road tax. A cash tax also is collected, most of which goes to payment of supervisors, purchase of implements, tools, material for bridges, etc., and in certain cases a portion of it is used in building or rebuilding bridges and opening new roads. These latter are usually let by contract, but all the work done on roads once opened is done by labor of taxpayers under direction of the supervisors. I know of no place in northeastern Pennsylvania where the contract system is practiced, but I understand that in some districts of Chester County that system has been in operation for many years."

From B. A. Joy, commissioner of highways, Springport, Mich.: "My own experience is that one-half of the labor tax as now assessed, if paid in money and applied on contracts when most needed, would do much more permanent and efficient work in road improvement."

From G. L. Tremain, Humboldt, Iowa: "Contract system has never been employed here. Road work is all done by district supervisors, and fully one-half of the fund is wasted through incompetent men."

From Wm. Steyh, city engineer, Burlington, Iowa: "The care of country roads in Des Moines County, and perhaps in all other counties of Iowa, is still in the hands of district road supervisors, under whose direction the road tax is worked out, at such times when it will not interfere with farm work, and consequently our roads are hardly ever in good condition."

From John G. Avery, Spencer, Mass.: "In this town we have road commissioners who have charge of our roads and the work is done 'by the day,' the laborers being residents of the town. We have several miles of macadam and telford road. The telford road in the country where the roads are used mostly for teams for marketing are usually narrow and in many places in the spring of the year very soft. The telford has been used to good advantage in converting these almost impassable roads into good ones. I do not believe in contracting for road making; as a rule a road contract can not be lived up to by either party, as changes are demanded which were not thought necessary when the contract was awarded. Have good overseers and let them see to it that they employ good help. Our State has contracted some road work near me which I have watched with considerable interest, and believe it is bad policy for the State to contract the work. I have seen them building roads in France, Austria, and Germany, and I believe they do not contract their work. Then I saw them at work in Hungary; it was being done under military supervision."

From R. G. F. Candage, Brookline, Mass.: "In Massachusetts the town is the unit, as is the case in the other New England States, and, although the county commissioners have delegated to them certain powers and control of laying out county ways, the towns through which they pass are charged with the duty of construction and maintenance of the same, and only in default of the action of the town do the county commissioners assume control of construction and repairs. Repairs in this State of county ways are not made as a general thing by contract, but are carried on under direction of the towns, and the manner and character of the said repairs might vary somewhat in the different towns, but it is safe to say that said repairs would be on a par with the character of the town ways through the roads which are called upon to make the repairs."

From Clayton Conrow, Cinnaminon, N. J.: "We in this section of New Jersey have the roads repaired by day labor. We believe it is better for us than the contract system."

From William W. Hooper, Leavenworth, Kans.: "My opinion would lead me to adopt the contract system, it being far superior to the working road tax system we now have."

From John L. Mandeville, Brookton, Tompkins County, N. Y.: "Of all ways, the most expensive is the labor system, and probably the least expensive is the contract system."

From J. N. Muncey, Jesup, Iowa: "The old, extravagant method is in vogue in this county, namely, paying the road tax in labor. Effort was once made in the township to require the payment in money and adopt the cash system, but the small majority in some 250 votes favored the old method. It is greatly to be regretted that the cash and contract system has not been extensively adopted in this county and State."

From E. Kostomlatsky, Oskaloosa, Iowa: "The contract system of road building is very little used in Iowa, but in one or two cases where it has been used it has given satisfaction. We need more of the contract system, as our roads here are just excuses, and so long as they are worked in the way now followed, they always will be."

From Ethan Brooks, West Springfield, Mass.: "In this section of our State a large portion of the expense of roads comes in applying gravel, which we find abundant in sections one to three miles from the ground needing it. In some of our near-by hill towns the contract system was formerly sometimes adopted and seemed generally to give satisfaction, as it was for the interest of the contracting party to keep the roads from getting out of repair."

From J. L. Minton, Napier, Mo: "Our roads are constructed and maintained by a road poll tax, which is very unsatisfactory and insufficient."

From Hon. Levi Chubbuck, Kidder, Mo.: "The contract system has been adopted to only a limited extent in Missouri. There is a growing sentiment in favor of the contract system in this State. At the recent Good Roads Convention held in Columbia, Mo., January 16-18, a resolution was adopted to the effect that the convention favor the contract system for constructing roads."

From James Yuill, Cedar Rapids, Iowa: "The system, or method, of working roads in Iowa is probably the worst that could be devised, as the State law permits the road tax to be paid in work. About ten years ago the county supervisors were authorized to levy a tax of one mill on the dollar (less than one-fourth of the road tax), and where this tax has been levied it has been expended under the contract system. In this county (Linn) it has been expended in making permanent improvements, such as cutting down hills, filling up low places, draining and macadamizing, and it is the general opinion that the roads derive more material benefit from the tax expended by the county than from the work done under the road district system. Good roads we never will have so long as the road tax is so largely payable in work."

From S. G. Mayfield, Denmark, S. C. : "We have tried in this State the contract and free labor and the commutation tax systems upon our country roads. Pickens County, which is a mountainous one, has perhaps the best dirt roads of any county in the State. Instead of crossing the hills as the old roads did, they were laid off so as not to exceed a rise of seven inches to the rod. This was done by Absalom Talley, who now resides at Marietta, Greenville County, S. C. Mr. Talley, while county commissioner of Pickens County, had this work done, extending through a period of twelve years, by using all of the labor which would be given to him by the farmers through whose lands the new roads were built, together with the aid of the road hands. Greenville County has this year leased or contracted her roads; they are dirt roads of the clay kind and such as you would find in any mountainous county. The attempt, however, has not proved satisfactory. In Spartanburg County the supervisor has bought a road machine and done some work which has been satisfactory. In York County several miles of first-class stone roads have been built, but the greater portion of the roads are such as you would find in any hill country—clay, half gravel, and rock—and all worked by the road hands. In Aiken County the road hands were relieved from road duty and a commutation tax of \$1 was substituted, with instructions to the supervisor to work the county convicts and to lease out the roads, but the county was so badly in debt, and this and other things prevented this, and it failed. In Barnwell County we passed a special road law, which is based somewhat upon the Mecklenburg County law, and have attempted to ditch our roads and have them thoroughly worked. We pay our overseers \$1 per day and have a fully equipped chain gang, together with a first-class supervisor. The convicts have been confined to the repairing and building of the heavy causeways and bridges and to the cutting down of the heavy grades. I am now preparing a bill to be introduced at the legislature, which is now [January, 1896] in session, which enables the various counties to get more convicts from the State penitentiary and to have a fund to erect some good roads, the leading feature being the improvement of the dirt roads."

From Halsted Smith, Rome, Ga. : "The general law of road working operative in this country is that the county is divided up into road districts; in each road district there are three road commissioners. These commissioners subdivide the roads in the districts into sections, and place an overseer in charge of each section, with such number of hands as the commissioner considers necessary for this work, in that way dividing out all of the road hands of the districts. The hands are sub-

ject to as much as fifteen days' work during the year and are summoned by the overseer when required to work. This method answers very well in sparsely populated portions of the county and where the travel is light upon the roads, though even in such portions the roads in winter are in poor condition, as our country is a clay one and wet weather makes the roads very soft. Near the towns and along the main thoroughfares this method has been utterly inadequate, both for the want of necessary tools and of concerted, intelligent action over the whole line.

At one time a local law was passed, and our county roads were let out by contract, but as the tax was so small the amount of improvement in one year was so slight that the people became dissatisfied and had the contract system abolished. My own views upon the subject are that as between the two systems the contract one is much the better, for the reason that in the first instance the sentiment of the community is in favor of relieving the road workers, as they are the ones that have to do the work, while in the contract system the sentiment of the community would be in favor of holding the contractor to the strictest account, because the members of the community would not be workers, but would have to pay for the work.

The general system being found so inadequate, in November, 1881, a county working gang was organized from the misdemeanor convicts of this and some adjoining counties. Mules, wagons, scrapers, an engine and a rock crusher were bought and the gang, which has varied from forty to sixty hands, kept constantly at work since that time. The consequence is that all of the main thoroughfares leading from Rome, which is the county seat, have been macadamized for a distance of 5 to 12 miles out of Rome. In addition to this, it has assisted in macadamizing some of the streets of Rome, has built and repaired culverts and bridge piers, and approaches to bridges over streams on the county roads, and has made passable at all times the roads over which it has worked. The most of these roads prior to the working were almost impassable for a loaded wagon during the winter weather. These convicts have portable quarters, which they occupy during the spring, summer, and fall months upon the roads away from Rome. During the winter they have permanent quarters in houses, in which stoves are placed for heating at night and during weather which is unfit for them to work in. It is during the winter that they work upon and near the streets of Rome. The superintendent in charge of the convict gang estimates that he can grade and macadamize a road 16 feet in width covered with broken stone, 9 inches deep in the middle and 6 inches deep on the sides, at an average cost of \$1,000 per mile.

From my own observations and experience in these matters, I believe that in this portion of our country the solution of the road working question is to place our convicts upon the roads that require heavy and permanent improvement, and gradually extend the work as time permits. Upon those roads, which for the present absolutely require only light work, I believe the contract system would bring about better roads in a shorter time, and with very little more actual expense to the community than the present system, if you estimate the time spent upon the roads by the road hands at the value of a day's work.

These views I have drawn from travel upon the roads and through a connection of thirteen years with the board of commissioners of roads and revenues of this county, which board has general charge of all the roads of the county."

From John A. Myers, Morgantown, W. Va.: "In this State, so far as my observation goes, the system of repairing and maintaining country roads by requiring citizens to work a certain number of days, is wholly ineffective. In some counties of this State I believe contracts are let by competition, for keeping up certain sections or amounts of country roads. This works well where the contracts are properly enforced, and there is no reason why they should not work well if the specifications upon which the bids are based are properly drawn and enforced. Within the last few years the roads approaching this place (Morgantown) have been very materially improved by the use of road machines and contract work. In fact, it is the only way that we have been able to secure anything like satisfactory roads."

From Otto Dorner, Milwaukee, Wis.: "While our present State law leaves it to each town to determine for itself at the town meeting whether road taxes shall be paid in cash or "worked out," only a few towns, perhaps, have adopted the cash system. I think this is due to want of enlightenment on the subject, and the present efforts of our league are directed to this end. The subject is being widely agitated, and we are confident of sufficient success so as to amend our road laws in the next legislature in January, 1897, so that all road taxes will be paid in cash without any "ifs" and "ands." The farmer's institutes, of which there are about one hundred and ten this winter, are, all of them, making the good roads question a prominent feature, and their arguments are squarely in favor of the cash system. The press is also doing a great deal to help us upon the same lines."

From J. S. Rogers, Stanwick, N. J.: "Our township roads are kept in repair by two overseers of roads selected by the township committee, the moneys appropriated for road repairs being expended under the control of the committee and under the supervision of the overseers, who report to the committee. We have in this way kept our stone roads in excellent condition at a less cost per mile than for the old dirt roads. The methods employed on the new State-aid roads in this county are still rather crude and very expensive. It is probable these roads in the near future will be placed in the hands of the township committees of the townships in which the roads are located, the repairs to be made and bills rendered to the county for actual expenses incurred during the three preceding months."

From John M. Stahl, Chicago, Ill.: "In Adams County, this State, where I resided for several years, the contract system of road making and repairing has proved much better than the old system."

From H. O. Gray, Oregon, Wis.: "Our town has been building and repairing its roads for the last two years under the law of 1893 with satisfactory results. Our road taxes have been paid in money and we have had one commissioner to look after the whole town. It is my honest opinion that we have improved the roads more in that length of time than has been done in the twenty years before."

From Martin J. O'Malley, Waunakee, Wis.: "We adopted the money system in the town of Westport two years ago. We purchased a road grader, and we levied a two mill road tax instead of a four mill tax that we had been paying, working the old way."

The people are allowed to vote on the question at every election, and they are fully convinced that the cash system is the only true way of

getting good roads. There has been more work done on our roads during the last two years than in twenty years before."

From W. D. Hoard, Fort Atkinson, Wis.: "So far as the contract system is concerned in this State, I believe a general consensus of opinion is that no other should be used if a good road is desired."

From Geo. D. Gideon, Philadelphia, Pa.: "I have no accurate knowledge of the exact dollars and cents expended in road improvements in the vicinity of my residence in Delaware County, but I do know that some three years ago before the borough of Swarthmore was incorporated—it was then in Ridley Township, which had previously voted to expend some \$80,000 in good roads. I was given to understand from members of the committee on road improvements that about one-third more roadways were completed, under the contract system, for the same amount of money, than under the township supervisors of roads."

From Owen Lawson, Louisville, Ky.: "The plan followed in this State for maintaining country roads is that of working out the poll tax under the supervision of the road overseer. This plan is a failure in Kentucky, as it is everywhere else, and entails great loss of time, labor, and money without appreciable improvement of the roads. The macadamized roads of the State are almost entirely in the hands of corporations, and are thus removed from public control, except indirectly."

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

METHODS OF CONSTRUCTING MACADAMIZED ROADS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., June 6, 1896.

SIR: The Bureau of Highways of the State of California having requested Her Majesty's Office of Works to "acquaint them with the methods employed in England in the matter of highway improvement," the Marquis of Salisbury transmitted the following report prepared by the chief engineering inspector of the local government board to the ambassador of the United States who forwarded it to the Secretary of State with the observation that, "in view of the general interest felt in this subject, I venture to suggest that it would appear very expedient if the report now transmitted could be printed for public information."

The Office of Road Inquiry has obtained permission of the California Bureau of Highways to make any desired use of this report, and, in view of the many valuable suggestions contained therein, I would recommend its publication as Circular No. 21 of this office.

Very respectfully,

ROY STONE,
Special Agent and Engineer.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

Extract from a Report Prepared by the Chief Engineering Inspector of the Local Government Board.

INTRODUCTION.

Our country roads have not been made with any particular kind of material, or in any particular way, but have grown up just as the exigencies of trade or traffic demanded and according to no set rules or principles. They consequently present the greatest differences. While some are as wide as the widest streets in towns, others are mere lanes where two carriages meeting can not pass each other.

In England it can hardly be considered that there was any art or science in roadmaking till the early part of the present century, and it is almost impossible to enter into any discussion of the technical points in connection with the formation and maintenance of roads without referring to the maxims and practice of the great pioneer in this branch of civil engineering whose genius is not only universally acknowledged, but has even stamped itself on the European languages.

After a considerable experience of roadmaking in Scotland and elsewhere, John Loudon Macadam appears to have settled sometime before 1820 at Bristol, where he was made a magistrate of the county and appointed general surveyor of the roads in the district. When he took charge of these roads it is admitted that they were more or less in a deplorable condition, but in a very short time after they passed under his charge they were transformed as if by the wand of the magician into such an efficient state that all classes bore the amplest testimony to his suc-

cess, especially that class who had the best opportunities of judging and whose interests were pecuniarily affected by the state of the roads—the great coach proprietors before railways were introduced into the country. His experience, moreover, was not confined to any single county, but he was consulted by authorities in all parts of England, so that his knowledge of the subject, both in respect of its technical details and its actual practice was such as no one else possessed.

His experience, too, was of that highest kind which is derived from the actual carrying out of works over a wide field of action. He constructed roads on plains and over hills, on hard ground and on soft, over rocks and across swamps, with granite, with whinstone, with flints, with limestone, with gravel, and with every kind of available materials, and he appears to have carefully observed the results of his labors in each instance. These results were obtained, moreover, not with an increased expenditure but with an actual saving. His roads cost less both to form and to maintain.

Just as no work on roads is ever written without an explanation of Macadam's principles, so is it equally necessary in this paper to refer from time to time to those principles, and to discuss them in connection with the more extended knowledge and better appliances of the present day.

WIDTH OF ROADS.

There is nothing like uniformity in the width of the county roads in the Kingdom, some of which are as wide as 80 feet, while others are only one-tenth of that width, i. e., so narrow that even two carts can not pass each other on them. The average width, however, may approximately be taken at from 15 to 30 feet for the metaled portions. There is also no uniformity as to the footways. On some roads there are no footpaths on the sides at all; on others there is a footway on one side only; and on others, on both sides. Moreover, these paths, which are usually of gravel and raised from 6 to 12 inches, but in some places much more, above the metaled portions of the road, and which generally slope toward the carriage ways, differ much in width.

In some places, also, there is a strip of greensward on the side of the carriage-way which is used by equestrians, sheep, and cattle.

These same observations apply also to all other roads in the country. There is no more uniformity to be found in them than in the county roads. They vary in width exceedingly, being in some places as wide as first-class county roads, and in others dwindling down to exceedingly narrow lanes. These roads, too, have in some places footpaths and in others none.

With regard to the proper width that should be given to roads, it is manifest that this should depend on the object to be served by the particular road. Main roads, which are the principal means of communication between large centers of population, must not only be wider than mere country roads, which run from village to village, or are only required for the purposes of farmers, but must be wider near towns than at a distance from them.

Macadam thought that "roads near great towns ought not to be less than 30 or 40 feet wide, but at a distance from great towns it would be a waste of land to make them so wide."

No hard and fast rule can be made unless it is that every road which is intended for carriage traffic should be sufficiently wide to admit of two carriages passing each other easily, otherwise the greatest inconvenience must be caused. The surveyor in designing new roads must be guided by his knowledge of the traffic of the district and must regulate their widths accordingly. For country roads the widths should be somewhat more than twice the width of the vehicles and carts used in the particular country or locality, so as to allow the wheels to pass each other easily, and for ordinary main roads twice this width would answer every reasonable purpose. If a road is made less than the width of two carts it should widen out for a short length, at regular distances apart, to a little more than the width of two carts, so as to admit of carts passing each other at these refuges; but this is at best an imperfect arrangement, as the drivers do not see each other till they suddenly meet, when one must go back to the nearest refuge to let the other pass.

It should be borne in mind that the cost of maintaining a well-formed road is not in proportion to its width, but more in proportion to the traffic passing over it, so that in laying down a new road it is better to make it too wide than too narrow. Greater width affords greater convenience to traffic, and the road is not so often under repair. A narrower road, for the same amount of traffic, is oftener under repair and wears out both horses and carts much sooner. This is particularly the case where the road is formed with inferior material.

GRADIENTS.

Inasmuch as the roads everywhere have been constructed as they have been required in times past, and without the technical knowledge of the present day, the gradients usually were made to conform in great part to the character of the country over which they passed, and where obstacles such as hills were met with, the roads were generally carried over them without any ruling gradient having been adopted. Some of the old roads with very steep gradients have been, or are being, gradually altered from time to time, but it would be very desirable to improve many others in the same way. Sir John Macneil advocated a ruling gradient of not less than 1 in 40; Professor Mahan, 1 in 33; and Telford, about 1 in 30. If a ruling gradient not steeper than 1 in 30 could be generally adopted throughout the country, except for very short distances, in cases where the cost would be out of all proportion to the advantage gained, an immense benefit would be derived by the public.

The limit of the longitudinal gradient for macadamized roads as to steepness should not exceed about 1 in 20, and as to flatness, about 1 in 100. A perfectly flat road is generally objectionable, in consequence of the difficulty of draining it properly, but the objection does not hold good if the road is raised above the surface of the country, and its drainage can be effected properly.

Although the first cost of a road with a good gradient may be greater than that with a steeper one, the subsequent charge of maintenance is in favor of the former, as flat roads with the same amount of traffic do not cost nearly so much as steep ones.

CROSS SECTION.

The gradient from the middle of the road to the side is a technical point of the first importance, and, as usual, it was Macadam who really reasoned out the principle which should guide the surveyor. He said:

"A road should be as flat as possible with regard to allowing the water to run off at all, because a carriage ought to stand upright in traveling as much as possible. I have generally made roads 3 inches higher in the center than I have at the sides when they are 18 feet wide. If the road be well made the water will run off very easily in such a slope.

"When a road is made flat, people will not follow the middle of it as they do when it is made extremely convex. Travelers generally follow the track in the middle, which is the only place where the carriage can run upright, by which means three furrows are made by the horses and the wheels, and the water continually stands there; and I think more water actually stands upon a very convex road than on one which is reasonably flat."

The cross slope, therefore, recommended by Macadam, viz: 3 inches in a road 18 feet wide, would be 1 in 36. For a road 30 feet wide Macadam also recommended a fall of only 3 inches from the center to the sides. This would be a gradient of only 1 in 60. There is no explanation of this apparent discrepancy in his practice, but he may have considered that a wider road might have a flatter cross section because it has generally a smoother surface. Another engineer, John Walker, who lived in Macadam's time, advocated that the surface of the road "should be made with a very gentle curve in its cross section, just sufficient to permit the water to pass from the center toward the sides. The declivity may increase toward the sides, and the general section form a very flat ellipsis, so that the side should (upon a road of about 30 feet in width) be 9 inches below the surface in the middle." Such a slope would practically be equivalent to 1 in 20, and would be much steeper than the best authorities in the present day recommend.

The slopes actually given to the roads in the country follow no rule. Some of the roads are almost flat, while others are very convex.

There is one serious disadvantage in giving the surface of the road an elliptical form, which is that the center portion has one slope while the sides have another. This is most inconvenient to traffic and actually dangerous to carriages moving at a great pace. The sudden change from one slope to another is very apt to overturn the vehicle, particularly if there should happen to be any loose stones lying on the surface. It is somewhat illogical, moreover, to advocate such a form for a road, as, if the flatter portion of the surface has a sufficient slope, the remaining portion must have too steep a one; or, again, if the sides have a proper slope, the middle of the road must be too flat. Extreme steepness at the sides practically narrows a road for use, and also tends to the more rapid destruction of these portions of the highway.

The slope should be regulated with the following objects in view :

The rain falling should be able to escape readily to the sides, but not with such a velocity as to create ruts on the surface.

The road should be as flat as possible consistent with the first principle, so as to offer no inducement to vehicles to keep to any particular part of it, and thus to wear that part out.

FOUNDATION.

Macadam thought a foundation of large stones or other suitable material for the metaling to rest on was not only unnecessary but that it was positively injurious.

A thickness of 10 inches of metalling well consolidated in layers of about 3 inches or so, and placed on a dry subsoil (a *sine qua non* with him), was in his opinion sufficient to carry the heaviest traffic even over soft ground. He never used large stones for a foundation in his practice of roadmaking. He said :

"The roads can never be rendered perfectly secure until the following principles be fully understood, admitted, and acted upon, viz: that it is the native soil which really supports the weight of traffic; that while it is preserved in a dry state it will carry any weight without sinking, and that it does in fact carry the road and the carriages also; that this native soil must be previously made quite dry, and a covering impenetrable to rain must then be placed over it in that dry state; that the thickness of a road should only be regulated by the quantity of material necessary to form such impervious covering, and never by any reference to its own power of carrying weight.

"The erroneous opinion so long acted upon and so tenaciously adhered to, that by placing a large quantity of stone under the roads, a remedy will be found for the sinking into wet clay or other soft soil, or in other words, that a road may be made sufficiently strong artificially to carry heavy carriages though the subsoil be in a wet state, and by such means to avert the inconvenience of the natural soil receiving water from rain or other causes, has produced most of the defects of the roads of Great Britain.

"At one time I had formed the opinion that this practice was only a useless expense, but experience has convinced me that it is likewise positively injurious."

The following evidence given by him before a Parliamentary committee shows still more clearly what views he held on the subject :

"I should think that 10 inches of well-consolidated material is equal to carry anything."

Query: "That is, provided the substratum is sound?"

Answer: "No, I should not care whether the substratum was soft or hard; I should rather prefer a soft one to a hard one."

Query: "You don't mean you would prefer a bog?"

Answer: "If it was not such a bog as would not allow a man to walk over I should prefer it." * * * "I think when a road is placed on a hard substratum, such as rock, the road wears much sooner than when placed on a soft substratum."

Query: "But must not the draught of a carriage be much greater on a road which has a very soft foundation than over one which is of a rocky foundation?"

Answer: "I think the difference would be very little indeed, because the yield of a good road on a soft foundation is not perceptible."

Macadam thought that a road lasted much longer over a soft than over a hard substratum, and independent evidence was given before Parliament to prove this in respect of a road between Bristol and Bridgewater, part of which ran over a morass, and part over a rocky foundation. It was contended by Macadam that the unyielding rock caused the road to wear away much faster. This seems, however, to be directly opposed to the experience of most engineers whose practice it usually is to secure as hard and unyielding a foundation as possible.

Macadam's great objection to laying down a bottom of large stones was that such a foundation acts "as a sieve which lets the water in which penetrates the whole mass, when the road is liable to give way in all changes of weather." Frosts and thaws were in his opinion the great evils to be guarded against, and no made foundation was equal to the natural soil in a dry state.

There is no doubt that little uniformity prevails in the country. It may safely be said that most of the old roads, if dug up, would be found to have little or no foundation, but many of those formed within say the last twenty or thirty years would be found to rest on foundations of stones, or ballast, or some suitable material of the kind.

When a foundation is used, a thickness of from 6 to 12 inches is recommended and over this from 4 to 6 inches of metal. But here, again, no hard and fast

rule can be laid down. The surveyor must be guided by circumstances—by the nature of the ground, the kind of material at his disposal, the traffic, etc.

It is manifest that a greater thickness of foundation should be given to a road where the ground is soft and the traffic is of a heavier nature than where the ground is hard and the traffic light. A less thickness of good tough metaling will suffice, than of softer material, which is liable to break under pressure.

Where roads are made without foundation, Macadam's rule will probably be found as correct as any. He considered 10 inches of metaling sufficient for any road, but, in carrying this out in practice, it must never be forgotten that Macadam insisted on the soil underneath being perfectly dry, and the metaling, after being properly prepared being thoroughly consolidated; so consolidated, in fact, as to prevent any water passing through it. It is this water getting under the surface and alternately freezing and thawing which destroys a road quicker than anything else.

DRAINAGE.

The drainage of the ground over which the road is to run is manifestly of the very first importance, because, unless every precaution is taken to insure that the soil on which the road rests is kept dry under all conditions of weather, as insisted upon by Macadam, the road is certain sooner or later to be destroyed.

In setting out the lines for a road the engineer should ascertain very carefully how the ground over which the road is to pass drains, so that he may be able to make the best use of the natural outfalls of the country, and thus get rid of the water from his road drains in the readiest way possible.

Walker particularly recommended that the side drains should be "on the field side of the fence with apertures in the fence for the water to pass from the sides of the road into them," but this is by no means a rule that has been generally adopted, nor is it always possible. The objection to it is the difficulty of getting at the drains at every point to keep them clear, nor can the men in charge of the roads so readily observe if a stoppage takes place and requires to be removed.

The drains are in some places within the fences and in others beyond; but wherever the drain may be placed, its width and depth must evidently be regulated according to local circumstances. In places where the drain after running short distances can relieve itself by discharging the water into some natural ditch or stream, its dimensions may be small, but where there is no natural outlet for a long distance the quantity of water which it will have to remove will be far greater and its dimensions will consequently require to be adjusted to these circumstances. It is therefore clear that in some places a drain 18 inches square, or even smaller, would more than suffice for its object, while in others a drain 3 feet square, or larger, would fail to carry away the water flowing into it.

In some situations, moreover, the road might intercept the surface drainage of the country, and provision would have to be made for the water which would naturally flow into the drain from the adjacent lands in addition to that from the road.

In adjusting the sizes of drains to roads one important consideration should always be borne in mind, and that is that the velocity of the water should not be so great as to wear away the sides and bottom of the drain. Sewers are made as small as possible to secure the greatest velocity and scouring power with a given quantity of water. The opposite principle must be borne in mind in designing drains for roads. The drain should rather be made too large than too small, and too wide and shallow than too narrow and deep, in order to reduce the velocity of the stream, so that it shall not destroy the drain. Deep drains by the side of the road are very dangerous.

The level of the water in the drains should be kept well below the material forming the road. Macadam considered 3 or 4 inches sufficient, but others recommend as much as a foot at least, and more even, if it can be easily obtained.

Where the road has a comparatively steep longitudinal gradient, and the water must flow with considerable force, it may be necessary to go to the expense even of a covered drain constructed with slabs of stone or stoneware pipes or masonry.

It is manifest that in some places drains would not be required on both sides of the road. One may suffice, but in these cases the water falling on one-half of the road would require to be conveyed to the ditch on the other side by drains laid under the roadway.

Some surveyors recommend that cross drains should never run at right angles to the line of the road, but in a slanting direction. One advantage of this is that a better gradient can be secured for the drain.

The surveyor should take great care that the line chosen for the road does not run over any natural springs rising to the surface. Such springs should be avoided if possible; but in cases where this is not practicable special means must be adopted to lead off the water by drains laid under the road.

When there is a footpath by the side of the road the water falling on that half of the road is conveyed to the ditch at regular distances apart by covered drains laid at a proper inclination under the path, and where the longitudinal gradient of the road is so steep that the water flowing alongside of the footpath is liable to cut up the surface, a proper paved or other suitable channel to resist the action of the water should be laid down.

Nothing so much conduces to the preservation of roads as good curbs and proper side channels for the removal of rain, but, unfortunately, curbs are seldom laid except in towns, and not near sufficient attention is paid to the construction of side channels which are soon worn into ruts by the rain.

HEDGES AND FENCES.

Air and sunshine are as necessary for the preservation of roads in good order as for the vigorous health of plants and animals. Water and want of light are among the most destructive agents in nature, and no road can be kept in order which is always in a damp state and on which the sun never shines. Everything, therefore, that prevents a perfect perflation of the air and obstructs the revivifying effects of sunshine is to be avoided.

Considered, then, from a purely engineering point of view, there is no doubt that a road would be all the better without hedges and fences of any kind, but inasmuch as a barrier of some kind or other between roads and the adjoining fields is absolutely necessary on other grounds, e. g., to keep cattle from straying from one to the other, to mark the limits of property, etc., a hedge may be considered a necessary evil, and the point therefore for the consideration of the engineer is how to minimize the evil.

Obviously, the higher and thicker the hedge the more obstruction must it offer to the sun and wind. The object to be borne in mind should be to erect such a barrier as first, shall allow the greatest amount of light and air to pass through it, and secondly, shall best answer the nonengineering purposes for which it is required.

According to these principles the best barrier would be one of iron, or of iron and wood combined, provided that it was sufficiently strong to resist being broken down by cattle, horses, etc. Iron wire should not be used, as it is easily bent out of shape, and cattle and horses are very apt to injure themselves in attempting to jump over the fence or to force themselves through it. Barbed wire is still more objectionable, and its use, which is cruelty to animals, should be strictly forbidden.

A strong iron fence forms, perhaps, the best barrier, but it is costly, and few authorities would be prepared to go to the expense of putting it up, especially as it deteriorates with time and entails a constant charge for maintenance in consequence of the corrosion of the iron and the necessity for periodically painting it.

Wood is not a suitable material for a fence, as it is easily destroyed by willful persons and rots under the effects of the atmosphere; but, if used, it should be oak or some other kind which resists rot as long as possible. Most kinds of wood are perfectly useless for the purpose.

The commonest fence in England is the quickset hedge, and its almost universal use is perhaps due to the fact that it is cheap and requires no skilled labor to maintain, but it is a mistake to suppose that a good quickset hedge can be established without care in planting and constant subsequent watchfulness.

One of the first engineers who drew attention to the importance of the subject of hedges in connection with roads was John Walker, who in his evidence before Parliament said:

"The fences on each side form a very material and important subject with regard to the perfection of roads; they should in no instance be more than 5 feet in height above the center of the road, and all trees which stand within 20 yards of it ought to be removed. I am sure that 20 per cent of the expense of improving and repairing roads is incurred by the improper state of the fences and trees along the side of it, on the sunny side more particularly. This must be evident to any person who will notice the state of a road which is much shaded by high fences and trees, compared to the other parts of the road which are exposed to the sun and air. My observations with regard to fences and trees apply when the road is on the same level as the adjacent field; but in many cases on the most frequented roads in England more stuff has been removed from time

to time than was put on; the surface of the road is consequently sunk into a trough or channel from 3 to 6 feet below the surface of the fields on each side. Here all attempts at drainage or even common repairs seem to be quite out of the question; and by much the most judicious and economical mode will be to remove the whole road into the field which is on the sunny side of it."

Mr. Law in his work on "Roads" makes some very useful observations:

"Few persons are aware of the extent to which a road may be injured by high hedges or lines of trees. Trees are worse than hedges, because they not only deprive the road of the action of the air and sun, but they further injure it by the dripping of rain from their leaves, as a consequence of which the road is kept in a wet state long after it would otherwise have become dry.

"When fences are indispensable they should be placed as far as may be from the sides of the road, and should be kept as low as possible. When there is a deep ditch on either side of the road it becomes necessary, to prevent accident, that the fence should be placed between the road and the ditch, but in other situations the fence should be placed on the field side of the ditch. In so doing the surface draining of the road into the side ditches is less interfered with and the action of air and sunshine is less obstructed by the fence.

"The different descriptions of fence which may be employed are various. In districts where stone is plentiful, and especially in the immediate neighborhood of quarries, where stone rubble can be obtained at a trifling cost, dry rubble walls, without any mortar, are very good and cheap and require little or no repair.

"For the road itself, an open post-and-rail fence is the best which can be employed, because it scarcely impedes the action of the wind and the sun upon the surface of the road, but the great practical objection to timber fences is their liability to decay, which occasions frequent and constant expense for renewal.

"The most common, and, all things considered, the most useful fence is the quickset hedge. If properly planted and carefully attended to for the first few years, a natural fence may be obtained sufficiently strong to resist the efforts of cattle to break through, and very economical in cost for maintenance. A bank or mound of earth at least 2 feet in depth should be prepared for the reception of the quicks, which should be three years' plants which have been transplanted two years. The best kind of soil is one of a light sandy nature admitting sufficient moisture to nourish the plants and retaining moisture in dry seasons. Heavy clay soils are not sufficiently pervious to water, and plants placed in such soils are never found to thrive. A mixture of peat or of rotten leaves is of great use and causes the plants to grow with much vigor. The quicks are most commonly planted in a single row, at distances of about 4 inches apart. But a much better hedge is formed by planting them 6 inches apart in a double row, as shown below, with a space of 6 inches between the rows,

O O O O O O O O O
O O O O O O O O O

and so arranged that the plants in one row are opposite the spaces in the other. By this arrangement, although the plants are really not so crowded, and have more space around their roots from which to derive nourishment than in a single row, they form a thicker hedge. The proper time for planting quicks is during the autumn or the spring, and, in fine seasons, the operation may be continued during the whole winter. A temporary fence should be put up to protect the young plants from injury, and the fence should be retained until the hedge has attained sufficient strength to require its protection no longer—a period, under favorable circumstances, of three or four years after the quicks are planted. That the plants may thrive they must be carefully attended to at first, and it is essential that they should be properly cleaned and weeded at least twice every year. Once every year toward the end of the summer the hedge should be judiciously trimmed, not to such an extent as to produce stunted plants, but by merely cutting off the upper and more straggling shoots, so as to bring it to a level and even surface. By proceeding in this manner, a neat, strong, and compact hedge of healthy plants will be obtained in about three years after planting."

Trees, however much they may add to the picturesqueness of a road add still more to the difficulty of keeping it in repair; and thick avenues, i. e., trees planted close to each other on both sides of a road, are quite incompatible with the due preservation of the surface. The evil is worse the narrower the road is, for then very little sunshine can get to the road at all, so that the macadam is constantly damp and wears away much more rapidly under traffic.

What are understood as boulevards are not so objectionable, because the roads are usually very wide and the trees are not planted so close as in an avenue, but from an engineering point of view, everything that interferes with the sun and prevents the circulation of air is objectionable.

MACADAM.

It is to the use of broken stone for the formation of roads to which, more than anything else, we owe the great improvement in the roadways of this country. It is not quite clear who really discovered the virtues of hard stones broken into small angular pieces, but John Loudon Macadam has probably a better claim to the title of discoverer than anyone else. He it was, at all events, who explained the principles of the use of macadam, the size to which stone should be broken, the manner in which it should be laid, and so forth, and thus it is that the kind of road he introduced has ever since borne his name, not only in England but in many foreign countries.

Macadam attached the greatest importance to the size to which stone should be broken. He said:

"The size of stone used on a road must be in due proportion to the space occupied by a wheel of ordinary dimensions on a smooth level surface. This point of contact will be found to be, longitudinally, about an inch, and every piece of stone put into a road which exceeds an inch in any of its dimensions is mischievous."

But he thought it a better plan to specify the size, not by its dimensions, but by its weight, and he fixed 6 ounces as the proper maximum weight of each piece. His reasoning was that by experiment he had found very little difference in the sizes of different kinds of stone broken to this weight, however much the stone might vary in specific gravity.

He said: "I hold six ounces to be the maximum size. If you made the road of all six-ounce stones it would be a rough road; but it is impossible but that the greater part of the stones must be under that size."

Whether Macadam was right or wrong, the principle he laid down has not been adopted in the country. Nowhere is the size of macadam regulated by weight, but invariably by dimensions. It is probable that the inconvenience of having to weigh stones in a balance to be carried about by the surveyor compared with the rapidity with which they can be measured by means of a gauge, has caused the former practice to be abandoned. Broken stone to be used for a road is now generally specified to be of a size so that it shall just pass in any direction through a gauge of certain dimensions.

Considerable importance is attached to the manner in which macadam is prepared for use. Machine-broken stone is not considered of the same value as that broken by hand. The stones are not of so regular a size and shape, and there is a greater proportion of inferior stuff. A mechanical crusher is apt to stun the material and does not leave the edges so sharp for binding as they are when the stone is broken with a small hammer.

It is probable that the crusher by its severe blows affects the interior constitution of the stone and renders the fragments more liable to split under the roller.

Macadam, who never thought anything regarding road-making beneath his notice, laid it down that stone should only be broken by people sitting on their haunches and striking it with a small hammer. This serves just to break the stone and no more. The edges are sharp and the fragments, not having received too great a blow to affect the internal structure of the stone, remain thoroughly sound and are tough enough to resist the crushing power of the roller. It should be borne in mind, however, that in Macadam's time mechanical stone crushers were not in existence, nor even were road rollers in regular use, although they had been invented.

Taking all these points into consideration, it is probable that the best size for macadam for hard and tough stones, such as basalt, close-grained granite, syenite, gneiss, and the hardest of the primary crystallized rocks, is from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches cube, according to their respective toughness and hardness, while stone of medium quality ought to be broken to gauge of from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches, and the softer kinds of stone might vary between the limits of 2 and $2\frac{1}{4}$ or $2\frac{3}{4}$ inches, but the latter is a size which should seldom be specified.

As in everything else in connection with roads, no hard and fast line can be drawn, but the surveyor must prescribe the size to which macadam should be broken according to this knowledge of the properties of the stone he proposes to use. Stones which bear even the same name are often as different in their properties as possible.

The present writer is opposed to the use of large macadam. Where the surveyor has only a comparatively soft stone to form his roads, with the better plan in his opinion is to break the stone to 2 or 2½ inches gauge, but in putting it down in any quantity to roll it at first with a light roller till the stones are fitted into their places and have become well consolidated. The passage of a heavy roller afterwards will not then be so apt to crush the material. Unfortunately most surveyors are so enamored of heavy rollers that very few are aware of the advantages to be derived from the judicious use of light ones, which are seldom to be found in the country.

ROLLERS AND ROLLING.

The proper method of rolling macadam and the best weight for rollers are very important questions in the formation and repair of roads. It does not at all follow that the best weight for a roller for one county or country is the best for all. In a district where the only materials to be had are more or less of a soft nature a much lighter roller is necessary than in one where the toughest basalts, granites, etc., are used. Heavy rollers would crush the soft materials to powder and so destroy them for all practical purposes. Such rollers, moreover, are quite unsuitable for roads under which there are water and gas pipes laid at an insufficient depth beneath the surface to resist the crushing power of a heavy load. The penalty to be paid for destroying a water or gas pipe is too serious to be lightly incurred, and before deciding on the weight for his roller, the surveyor should be careful to ascertain the positions and sizes of all the pipes under the roads in his district, together with the depths below the surfaces at which the pipes have been laid, or he may do much mischief before he becomes aware of it.

The present writer is of opinion that the use of heavy rollers, which has been growing of late, is a mistake, and is only to be justified in towns where it is desirable to finish roads as soon as possible, so that there shall be the minimum of interruption to traffic. The heavier the roller, the more liable is the material to be crushed under the load, so that, unless the very best material is used, a 15-ton roller is much too heavy for the object in view—most certainly for the general purposes of the surveyor in a county district.

When the materials used in a district are of different kinds, i. e., when granites, syenites, basalts, etc., are used for the best roads, and inferior stone for the minor ones, it is essential that there should be two rollers—one of a heavier, and the other of a lighter kind, each to be used on the materials suited to it.

The present writer is of opinion that a road formed with a light roller, although it can not be made to consolidate so soon, lasts longer than one formed with a heavier roller. The consolidation in the latter case is effected more rapidly, but at the sacrifice of much of the stone being broken or crushed into position. The lighter roller effects a truer binding of the macadam without breaking the stones into smaller fragments.

Even when the best and toughest materials are used, it will be found advantageous to begin the rolling with a light roller, and only finish with a heavier one.

In rolling fresh material the use of the light roller should be continued until it is observed that none of the stones advance from their positions, when the heavier roller should be brought onto the work, and its use continued until again it is found that no shifting of the macadam takes place.

MAKING A ROAD.

After the land over which the road is run had been properly drained and fenced in, the surface of the ground should be leveled, or, rather, brought to the form of the curve of the road, and all soft and boggy soil rectified, either by its removal and replacement with sound, hard material, or in some other way. Some surveyors recommend the use of faggots and brushwood, which, if used, should be laid down in fascines or bundles, one layer over the other and crosswise; but others consider the use of such a material for raising a road very objectionable, unless the brushwood is always in water. If it is alternately wet and dry, it rots, and its destruction soon follows, causing the road to sink.

The present writer is altogether opposed to the use of brushwood except across a morass, where it may be considered to serve the same object as that of pontoons across a river—i. e., to support the road and prevent its sinking through the bog.

Some surveyors recommend that the surface soil should be removed while others prefer not to disturb it. Here, again, common sense must dictate the proper course to be pursued. If the surface soil is suitable for a foundation and superior to that on which it rests, it should be retained, but if otherwise, it should be removed, so as to give the road the best foundation possible—i. e., the driest and firmest.

When all the soft and defective places have been excavated and refilled with good material, and the entire surface has been brought to the proper curve, the road should be well rolled with a light roller, and material should be added in the soft places as these sink from time to time. The rolling should be continued until no more sinking takes place in any part of the road, when the light roller should be taken off and a heavy one substituted in its place, the soft places again being made good with good material as they sink. When all sinking has ceased the surface soil may be considered fit to receive the foundation.

Where the soil is very soft, it will often be found impossible to use a roller at all, in which case the foundation must be put down before the rolling begins.

This foundation is formed in various ways, and, of course, with such materials as can be obtained in the district. When stones of a rather large size are used, they should be, as recommended by Telford and so many of the surveyors, hand-pitched with their broadest side downward, so as to insure them bedding properly, and the interstices should be filled with smaller stones. Then a layer of 2 or 3 inches of macadam should be put down and a thin sprinkling of some binding material should be thrown over the macadam. The road should then be well watered and rolled. When this has been thoroughly well consolidated the second layer of macadam, about 3 inches thick, with some binding material, if the stone is too clean, should be put down; when this has been well rolled and has become consolidated, carriages may be allowed to pass over the road.

The material used for foundations are of very different kinds, many being quite unsuited for the purpose; large stones of almost any sort, furnace slag and clinkers, ballast, flints, chalk, broken pottery, tin cans—any material indeed that can be found ready to hand.

The use of soft material in a foundation should be avoided if possible, as the effect of rolling the road will be to crush the material to powder, and this is the state to which such foundation must inevitably be reduced by the traffic in the course of time.

It is almost the universal practice now to sprinkle some binding material over the macadam before rolling it. This is usually gravel or sand or chalk or chippings from quarries. It is a practice, however, which Macadam condemned with all the force of his character. His opinion was that any material like sand, or fine gravel or chalk, allowed rain to pass through to the bottom, whereas, by rolling the macadam without the use of any binding material, the mass became so consolidated as to offer an impenetrable barrier to the passage of the water.

The views expressed by Mr. Law, C. E., in his "The Art of Constructing Common Roads," on this subject are worthy of much consideration. He says:

"If the materials of which the covering is to be formed are in angular masses no binding of any description is requisite, as they quickly become united by dovetailing, as it were, amongst each other much more firmly than they would by the use of any kind of artificial cement.

"When the stones instead of being angular are round and pebbly, like gravel stones, it is necessary to mix them with just sufficient foreign matter of a binding nature as will serve to fill up the interstices between the stones, for otherwise these would roll about and prevent the road from becoming solid.

"There are then two methods of cementing or solidifying the surface of a road—one by the mechanical form of the materials themselves, forming a species of bond; the other, by the use of some cementing or binding matter. And in comparing the relative merits of the two, the preference must certainly be given to the former—that in which the stones are united by virtue of their angular form without the use of any cementing material. The principal reason for this preference is that roads formed with stones so united are not materially affected by wet or frosty weather, whereas roads whose surfaces are composed of pebbly stones united by cementing material become loose and rotten under such circumstances, the cementing material becoming softened by the wet and reduced to a loose, pulverulent condition by subsequent frost."

Mr. Law reasons on the subject exactly as Macadam did, whose views the present writer indorses.

Some surveyors are of opinion that, in laying down macadam, it should be sorted into two or three different kinds, with the view to the larger-sized material being placed at the bottom and the smaller at the top. This is not recommended by the present writer.

Where the surveyors have expressed any opinion on the subject they seem to be nearly all agreed that the bottom of the road should not be leveled, but formed to the curve of the surface of the road, as it is to be when completed. When the natural ground on which the road rests is clay, or other impervious

soil, it is clear that to make the bottom of the road flat, is to induce the water percolating through the macadam and foundation to rest in hollows below, whereas, if the bottom is curved, the water is more likely to flow off to the sides, and thus to leave the foundation and macadam dry. Moreover, as the wear of the road should be the same in all parts, the thickness of the material should likewise be the same everywhere.

REPAIR OF ROADS.

As in the making and maintenance of roads it is essential that there should be abundance of water, without the use of which the surface can not be easily broken up, nor the macadam be got to consolidate properly, the best season for doing work of this nature is that part of the year when water is plentiful and can be easily got, and when the roads are softened with rain or moisture, i. e., the late months of autumn and early winter.

It is not considered a good plan to coat a long length of road with material at once, because, if this is done, vehicles avoid going over the macadam, and thus prevent it from consolidating quickly. If short lengths only of the road are put under repair, the drivers find it more troublesome to be constantly avoiding them than to keep straight on their course, and thus the material is got to bind much sooner.

After April and in summer, or the dry months of the year, all loose stones should be removed from the road, for, if allowed to remain, wheels passing over them loosen the material on which those stones rest, and thus cause much damage to the surface of the road.

The proper maintenance of a road consists in keeping the surface always smooth for traffic and in taking care that the thickness of the macadam is not unduly diminished by wear. A road may be smooth on the surface, but, if the material is nearly worn away, it can not be considered to have been properly maintained. To keep a road in an efficient manner unceasing vigilance is required. Ruts and hollows should be at once filled in with macadam, and all weak places as soon as observed treated similarly.

A common fault is to put too great a thickness of stone down at once. Penfold says:

"It is one of the greatest mistakes in roadmaking that can be committed to lay on thick coats of materials, and when understood it will no longer be resorted to. If there be substance enough already in the road, which, indeed, should always be carefully kept up, it will never be right to put on more than a stone's thickness at a time. A cubic yard, nicely prepared and broken to a rod superficial will be quite enough for a coat, and will be found to last as long as double the quantity put on unprepared and in thick layers. There is no grinding to pieces when so applied; the angles are preserved and the material is out of sight and incorporated in a very little time. Each stone becomes fixed directly and keeps its place, thereby escaping the wear and fretting which occur in the other case."

For repairs of this nature, where, in fact, the mere surface of the road only is sought to be put in order, no binding material is used or necessary. The wheels of the carriages gradually push the stones into their places, and make them bind with the old material on the road. Some engineers are of opinion that no macadam should be laid down, however thin the coating may be, without the surface of the road being roughened with a pick. There is no doubt that this tends to make the new material bind with the old much sooner, but, on the other hand, it tends to disturb and to weaken the crust if it should be very thin.

For more extensive repairs, i. e., when a road has been allowed to become very thin, and it is necessary that a considerable thickness of material should be laid on, the road must be what Macadam termed "lifted," or broken with a pick to the depth of 2 or 3 inches, and all large stones must be thrown aside to be broken to the required dimensions. A thin layer of new macadam must now be added and the road rolled. It will usually be found that no binding material will be necessary. When this layer has become consolidated, another, 2 or 3 inches thick, should be laid down and again rolled, and so on until the desired thickness of material for the road has been obtained.

Macadam objected to the use of any binding material, such as gravel, sand, chalk, etc., being used with the view to help the macadam to bind, but the almost universal practice now is to sprinkle some such material over the macadam before rolling it.

The present writer's views accord with those of Macadam. In his opinion the bad state of many of the roads in the country and the constant repairs required to them, are in great part the result of the use of binding materials, which being

invariably of a pervious nature, afford the rain innumerable passages through the macadam to the foundation underneath. Thus, not only is there water below the road, but the macadam and foundation are so thoroughly saturated with wet that no power on earth can possibly resist the loosening, disintegrating and destroying effect of a few alternations of frosts and thaws.

No road should be lifted unless it has been softened with rain, and there is plenty of water to finish the work of reformation. To lift and remake a road in dry summer weather should not be attempted. The work should be deferred to the later months of the year, but not too late, lest frosts should set in. Some engineers consider October the best month in the year for lifting a road, so that the material may be sifted and sorted when dry, and be consolidated in November and December.

It is, indeed, of great importance to avoid all extensive work on a road if there is any likelihood of frost, for the effect of a frost and then a subsequent thaw on macadam recently laid after it has been well watered and has just become consolidated, but is still saturated with rain, is not only to loosen it, but also to disintegrate the material.

Macadam thought that a road which had a sufficient thickness of stone but was out of order should not be repaired with new material, but by picking up the old stone and reforming the road with it.

He said :

“No addition of materials is to be brought upon a road unless, in any part of it, it be found that there is not a quantity of clean stone equal to 10 inches in thickness.

“The stone already in the road is to be loosened and broken up so that no piece shall exceed 6 ounces in weight.

“The road is then to be laid as flat as possible. A rise of 3 inches from the center to the side is sufficient for a road 30 feet wide.

“The stones when loosened in the road are to be gathered off by means of a strong, heavy rake, with teeth $2\frac{1}{2}$ inches in length, to the side of the road and there broken, and on no account are stones to be broken on the road.

“When the great stones have been removed and none left in the road exceeding 6 ounces, the road is to be put in shape and a rake employed to smooth the surface, which will at the same time bring to the surface the remaining stone and will allow the dirt to go down.

“When the road is so prepared, the stone that has been broken by the side of the road is then to be carefully spread over on it. This is rather a nice operation and the future quality of the road will greatly depend on the manner in which it is performed. The stone must not be laid on in shovelfuls, but scattered over the surface, one shovel following another and spreading over a considerable space.”

A little new macadam, however, mixed with the old will considerably improve the surface of the road. The old material lifted with the pick, even if broken afresh, never has the sharp edges of new macadam, and much of it is too rounded to bind in the same effective manner as freshly-broken stone. Moreover, a great portion of the old macadam when lifted will be found to consist of material which has been reduced either to dust or to too small a size to be fit for subsequent use. This material ought to be rejected, or, if used, it should only be employed for binding purposes.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

Washington, D. C., June 25, 1896.

It is manifestly desirable for the promotion of the investigations of this Department regarding public roads and the dissemination of information thereupon, to encourage the organization of State and local road improvement societies, through which means a great amount of voluntary aid has been given to this work in some of the States. The following appeal for the promotion of such an organization in the State of Tennessee has therefore been recommended for publication and distribution as a circular of this office.

Approved:

J. STERLING MORTON,
Secretary of Agriculture.

ROY STONE,
Special Agent and Engineer.

NASHVILLE, TENN., *June 19, 1896.*

DEAR SIR: Several gentlemen who are believed to feel such an unselfish interest in the State's prosperity as to be willing to aid any enterprise conducive to the public welfare, have been selected from each county in Tennessee as proper persons to approach in the interest of good roads. You are one of these.

The inclosed list of those in your county to whom this letter has been mailed is sent that you may consult with them should you desire to do so. A copy of this letter has been sent also to each member of the general assembly and to the chairman of each county court.

Within the last ten years several States have enacted laws which enable their citizens to build good, permanent roads at a cost so moder-

ate as scarcely to be felt by the individual taxpayer. By judicious, businesslike management, in which no more is undertaken than can be thoroughly and permanently accomplished, the State gradually, and in less time than would be anticipated, becomes possessed of creditable highways, free to everyone, whose cost has been a burden to none and whose benefits are enjoyed by all, and everyone is amazed that this was not done long ago.

The McMinnville "Southern Standard" expresses the benefits of good roads in the following earnest words:

Good roads can be built all over this county without burdening the people if systematic, businesslike methods are employed in the work. Every mile of pike road built in the county will increase land values, improve morals, elevate the citizenship, stimulate trade, beautify the country, promote educational interests, raise the standard of religion, and add to the wealth, health, and happiness of the people. Are not all these ends worthy of consideration?

In view of the importance of the subject and realizing that a State with bad roads can not compete with those having good roads, the laws have been collected which have enabled other States to build roads not only satisfactory to the people but of which they are justly proud. It is hoped that Tennesseans may use these as a basis for future road laws, thus profiting by the experience of others and avoiding their mistakes.

That the making of road laws which will give us good roads and not burden the people with onerous taxes is no easy matter, is shown by the innumerable and inoperative road laws on the statute books of our own and of other States. Is it not wise for us to profit by the experience of others and avoid their failures rather than to venture upon untried laws of our own making?

There are few subjects on which our citizens are so erroneously informed as on that of road construction, and they need instruction as to the best methods of doing this work. Could every Tennessean actually travel once on really good roads, or if one mile of good road was constructed on one of the most traveled highways in each county in the State, so that the people might see the difference between it and the present roads, they would demand proper road construction, and good roads would soon be an accomplished fact.

The object lesson presented by a mile of smooth, easy graded mountain road, or a fine, well-made road in the sand and clay country of west Tennessee would do more to impress the people than volumes of written or oral instruction.

In the last-named part of the State there are hundreds of miles of miserable road which can be made good or materially improved by simply draining them and using the sand and clay everywhere present in proper proportions to form a hard, smooth, and firm roadbed.

If ybu are willing to join in an effort to secure better and permanent roads for our State, and to effect this in an economical, business-like manner, without burdensome taxation, please notify the writer by postal card or letter. Should the replies to this letter indicate that a majority of those receiving it really and earnestly wish the State to have better roads, a congress of Tennesseans will be called in the near future to discuss the question ; to learn what other States have accomplished in this line, that we may profit by their experience ; and especially to secure united concert of action by Tennesseans for the good of Tennessee.

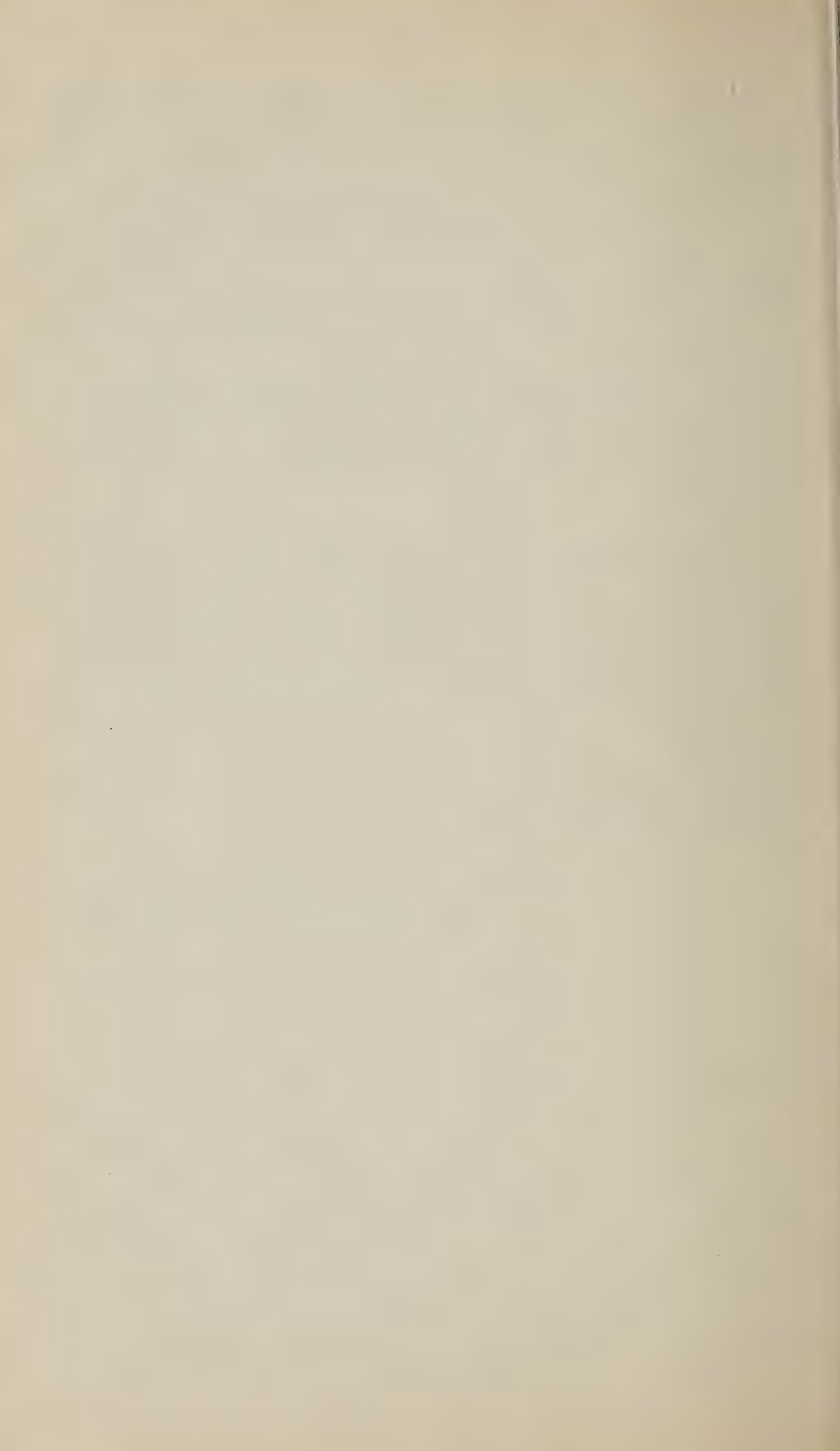
If you can not cooperate with us kindly hand this to an influential neighbor who will help in this matter. It is of more vital importance to the welfare and prosperity of our people than any question now before them.

In asking your cooperation we do not ask that you leave home to attend this congress, as when the time comes those interested in the subject will be asked to name delegates from each county. In the meantime, and at all times, independent of this, you are earnestly invited to work for better roads and especially to encourage others to do so. Encourage them by showing what others have actually accomplished by systematic, businesslike, economical methods and that we, by abandoning the old, aimless, and temporary way for these better methods can accomplish as much.

There is but little difference in the cost of the two ways, but there is an immense difference in the results.

Address your reply to—

C. A. LOCKE,
*Member from Tennessee of Advisory Committee of
 National Road Conference, Nashville, Tenn.*



United States Department of Agriculture, OFFICE OF ROAD INQUIRY.

Washington, D. C., July 15, 1896.

SIR: I have the honor to transmit herewith and to recommend for publication as Circular No. 23 of this office an important paper by Prof. W. C. Latta, of Purdue University of Indiana, upon the "Money Value of Good Roads to Farmers."

The information furnished in this paper is in line with that contained in Circular No. 19 of this office, and with the conclusions of the New York Highway Manual and the calculations of the secretary of the Farmers' National Congress. Of these four various estimates of the value of good roads Professor Latta's is the lowest, but it may be held to support the others, since they are based upon roads of a higher class than the Indiana gravel roads and since they go more elaborately into details of the advantages of good roads. Even upon this estimate, however, the loss by bad roads for the whole farm area of the United States would be very close to \$500,000,000 annually.

Very respectfully,

ROY STONE,
Special Agent and Engineer.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

MONEY VALUE OF GOOD ROADS TO FARMERS.

That good roads have a money value to farmers will be granted by all. That the money value of improved highways is alone sufficient to justify the cost of their construction, will be confidently claimed or readily admitted by many farmers, questioned by others, and denied by not a few.

In view of the financial and many other advantages of good roads, a majority of the farmers of the State would doubtless favor their construction as rapidly as practicable under some efficient, economical, and equitable system of highway improvement. But there is a considerable proportion of the farmers—doubtless one-fifth and possibly one-fourth—who have little knowledge or appreciation of the benefits of good roads and who, therefore, object on account of the great cost of highway improvement. The farmers of this class know that they will have to bear their full share of the burden of such improvement; they discredit (not wholly without reason) the statements and conclusions of many public writers as to the losses and gains to farmers from poor and good roads

respectively; hence they view with apprehension the general agitation in favor of improved highways. Ignoring or undervaluing the educational and social advantages, as well as the comfort and enjoyment of good roads, or feeling unable to pay the price of such benefits, these farmers regard with distrust and disfavor measures for highway improvement; and they are likely to oppose efforts for the betterment of our roads unless they can first be convinced that good roads will prove a paying financial investment. Speaking, therefore, in behalf of those who for any reason are not influenced by the higher considerations in favor of improved highways, I raise the question, Will it pay the farmers in dollars and cents to improve their public roads?

Before attempting to answer this question, let us consider in what ways permanently good roads will prove financially beneficial to farmers. All will agree, I think, that a good road will—

(1) Economize time and force in transportation between farm and market;

(2) Enable the farmer to take advantage of market fluctuations in buying and selling;

(3) Permit transportation of farm products and purchased commodities during times of comparative leisure;

(4) Reduce the wear and tear on horses, harness, and vehicles;

(5) Enhance the market value of real estate.

But while it is easy to enumerate the ways in which improved roads will be financially advantageous to farmers, it is very difficult to estimate, in dollars and cents, the benefits to accrue therefrom. Distrusting my own judgment in the premises and fearing, also, that my opinions would have little weight with others, I sought the advice of the farmers themselves. Letters of inquiry were sent to sixty of the most intelligent farmers in forty counties located in the central and northern parts of the State. The substance of these letters is given herewith:

(1) About what proportion of the public highways in your county are now good gravel roads?

(2) Please estimate the average increase (in dollars and cents) in the selling price per acre of land throughout the county, as the result of such gravel roads.

(3) If all the public roads in your county were converted into improved highways, how much, in your judgment, would it increase the average selling price per acre of land throughout your county?

(4) What would be a fair estimate of the cost per mile of converting our common dirt roads as they now exist into good gravel roads, provided, of course, the work were to be performed economically under some competent, general supervision, and not hampered by legal restrictions?

(5) Supposing that your county were divided into 100-acre farms and that the average distance of each farm from market were 5 miles, what, in your judgment would be the average annual cost (in dollars and cents) to each farmer of our unimproved highways?

In answering the fifth question please take into account the reduced loads, increased time, extra wear and tear, and loss in sales from inability to deliver products when the market is best.

Over forty replies to these queries were received. As would be expected, from the difference in soil, surface, and distance from gravel beds, there is a wide range in the estimates of the different correspondents. Many of the estimates are necessarily mere guesses, while others are based on a thorough knowledge of the matters under consideration.

The averages of these estimates should give—and they probably do give approximately—the consensus of opinion, held by the most intelligent farmers of the State, as to the cost and money value of improved highways and the loss due to poor roads.

The approximate averages for the forty counties are as follows :

First: The average estimated increase in the selling price of land due to existing improved highways is \$6.48 per acre. The estimates from which this average is made refer in most cases to lands near the improved roads; but in a few instances they apply to all the lands of the county. The average increase, therefore, of \$6.48 per acre is lower than was intended for the lands near the improved roads.

Second: The estimated average increase per acre that would result from improving all the public roads is \$9.

Third: The estimated average cost of converting the common public roads into improved highways is \$1,146 per mile.

Fourth: The estimated average annual loss, per 100 acres, from poor roads is \$76.28.

If these estimates are even approximately correct, they furnish a key to the satisfactory solution of the question of highway improvement from the money standpoint. On the basis of the last mentioned estimate the average annual loss per acre from poor roads is over 76 cents. In five years the losses would aggregate \$2,432 for every section of land, and this sum would construct two miles at a cost of \$1,216 per mile, which is \$70 per mile above the estimated average cost given by the farmers themselves. The present road tax which, under existing laws, is largely thrown away, would, under a proper system of road maintenance, doubtless keep improved highways in perfect repair.

If the foregoing statements are a near approach to the truth, it follows that the losses and expenditures which farmers actually incur on account of poor roads would also secure permanently good roads. Can any sane mind doubt the wisdom of exchanging the losses, delays, accidents and vexation of spirit, occasioned by bad roads, for the comfort and other advantages of good roads when the cost is the same?

But there is another side to this question, viz, the increased value of land from highway improvement. As already stated, this increase is estimated by the farmers consulted at \$9 per acre. This would enhance the value of each section of land \$5,760 which is more than double the estimated cost (\$2,292) of the two miles of improved highway, which constitute the quota for the section. Just here the objection may be raised that the improved roads would not increase the productive capacity of the land, while the enhanced commercial value would increase the taxes. Let us, for the sake of argument, grant this plausible but fallacious objection, and then find what it amounts to. Let us suppose the increase in appraisement for taxation to be \$4 per acre, and the tax rate $1\frac{1}{4}$ per cent. This would mean an annual increase in taxes of 5 cents per acre, or \$5 per hundred acres. Would not our objector, after enjoying the benefits of good roads, be very willing to give therefor the extra \$5, if necessary? Would he keep the money and go back to the thralldom of mud roads? If so, he has the option of selling his farm at an advance, according to the average estimates of his brother farmers, that will more than doubly reimburse him for his expenditure on highway improvement; and he can then remove to some native wild whose quiet waters have not been "troubled" by the spirit of progress.

I am aware that many intelligent farmers will not accept the estimates of their fellow farmers as to the money value of good roads—many who will even deny that improved highways have any appreciable money value. I am glad to know, however, that many of these very

same farmers favor good roads, and would aid in their construction for the same reason that they would build for themselves comfortable and even luxurious homes.

In view of the very general recognition among farmers of the necessity and benefits of good roads, I am encouraged to believe that a very large proportion of the farming classes will heartily join with the people of the cities and towns in an effort to devise, adopt, and put into execution some efficient, economical, and equitable system of highway improvement.

In conclusion it is but just to those who have kindly furnished data for this paper to say that their estimates of losses due to poor roads apply only to live, enterprising farmers who would reap the full benefits to accrue from improved highways. That there are some who would realize little substantial gain from highway improvement must be admitted, but to base an argument against good roads on this fact would be to do gross injustice to the great majority of industrious, thrifty, enterprising farmers who are doing so much to make Indiana one of the foremost agricultural States of the Union.

W. C. LATTA.

PURDUE UNIVERSITY, LA FAYETTE, IND.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

WASHINGTON, D. C., November 24, 1896.

HIGHWAY REPAIRING.

SIR:

I have the honor to transmit herewith a communication from the Hon. J. O. Sanford, of the Vermont Board of Agriculture, giving some valuable details of practical benefits secured by the daily care of country roads; also a memorandum by Mr. E. G. Harrison, road expert of this office, relating to the roads improved by farmers at Canandaigua, N. Y.; also opinions of leading citizens in the States of Wisconsin, Iowa, and Indiana, relating to the working of a cash tax in those States.

I would respectfully recommend the publication of these articles as Circular No. 24 of this office.

Very respectfully,

ROY STONE,
Special Agent and Engineer.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

Practical Results of the Daily Care of Common Roads.

Being interested in the subject of good roads and studying the matter from a practical standpoint, I became convinced that prevailing methods were very extravagant and ineffectual to accomplish best results in furnishing to the public satisfactory roads. The system requiring a pathmaster, or surveyor, in each neighborhood to warn out the inhabitants once a year at a convenient season and go over the roads of the town to repair the damages caused by neglecting them all the rest of the year is not well adapted to this business-like age.

The ordinary country roads do not wear out. They wash out and freeze out. Water is the great road destroying element. This should be recognized in the maintenance of roads as well as in their construction. The action of water and mud, which is water and the road material mixed, upon the road surface are the chief causes of poor and unsatisfactory roads. The damage caused by water on the road surface can be prevented by maintaining at intervals properly constructed water bars, or mounds, more or less elevated, according to the incline or slope of the surface, with water courses always kept open to carry away the water where it will do no damage.

Muddy roads are prevented by excluding the water. Wherever water stands upon the road or in pools beside the road during the fall months, there we have the troublesome mud. The roadbed being perfectly saturated, the process of freezing separates each particle of material from every other particle. The thawing process gives the mud. All this can be prevented by getting rid of the water

Ordinarily the chief work done by country people on highways is repairing the damage consequent upon neglect. Why this neglect? Simply because the people are trying to follow old, obsolete methods poorly adapted to these times of intense business energy and economy.

Much may be learned from the methods employed in maintaining the railroads. The means adopted to keep up our highways would be considered extravagant for them. The principle of economy forces them to a better system—one of constant and continuous work of repairing.

In the spring of 1894, with the purpose of adopting better methods for road management, I asked the people of my town for the office of road commissioner, and being elected to that office, I proceeded to institute a system of continuous inspection and repairs. Being familiar with all the roads of the town, and the uses to which they are put, I divided them into sections and made choice of the men who should have charge of and keep each section. My next task was to see other men and endeavor to enthruse each with some spirit of improvement. They were reminded that the value of their farms depended upon the condition of the road. They were assured that the roads were to be improved, and urged to use their best endeavors in inaugurating reform in our methods of road management.

Each man was furnished with a good, new shovel and a pass book in which to charge for each and every hour he spent upon the road. He was instructed to go over his section as soon as the ground was bare of snow, or as soon as the water began to flow; to see to it that the water was kept off the road; to go over the road every day if necessary while the snow was going and during the rainy season, for it is then that the most damage is done; and that when so passing over the road he should remedy all slight defects where a few shovelfuls of earth or gravel would prevent a bad mud hole later on. These men were told that the old way of working the road once a year had been abandoned, and that it was expected that a few hours' work each week, when it would not seriously interfere with their farm work, would accomplish all that was expected.

The main road through the town, six miles long, not only takes the travel of the other roads, but is the thoroughfare by which the inhabitants of other towns reach the city with their produce, lumber, wood, and a great deal of heavy trucking. The best farmers live along this road and have enough business of their own without caring for a section of road. Because of this, and for various other reasons, I conceived the idea of employing one man to keep this road, and therefore engaged a faithful man with his horse, the town furnishing a cart.

He was employed from spring till fall, and his instructions were to begin at one end and work one mile each day, covering the entire route each week, and fixing the worst mud holes (and there were many), using the best road material at hand; and at the close of each day to pass over the mile worked, gathering the loose stones, putting them where they would give no more trouble.

I will say here that the maintenance of this road was and had been a great burden to the town, and its condition was far from satisfactory to the traveling public. When the man employed learned what was expected of him, he shrank from the task, saying, "What can I do to keep this road when a large gang of men with great expense has failed to keep it?" He was only persuaded to make the attempt by the assurance that the responsibility and any bad results would rest on the commissioner.

There was much ridicule and prejudice against this system of management for a time. The man employed was instructed not to participate in any discussion of the subject, not to answer questions relative to the road or his work upon it, and to refrain from talking about the matter generally on penalty of being discharged. Other people talked and ridiculed, but the work went on, and after a few weeks the condition of the road improved, and people noticed the fact. They also discovered that the expense was not large; that all the work done was remedying defects and at the same time preventing greater ones. And so the work went on and prejudice died out. At the next annual town meeting the people without opposition continued the system, and at the last town meeting elected the road commissioner for three years with the same system of road management.

The general results are that much better roads are secured at less expense, and the tax rate for highways has been reduced each year, as the roads grew better, and as we learned to maintain them free from damage at less cost.

I will say we do something more for the roads than is here indicated. What we do is for maintaining or holding them, and at the same time improving. But these roads should be built according to modern ideas of road construction; so we set apart a portion of the road fund for permanent improvement, building up each

year a piece or section of the main road in a thorough manner and of good material, and constructing culverts of stone in a permanent way. After the road is put in good condition one man can easily keep and care for a long stretch.

Very truly yours,

J. O. SANFORD,
Vermont Board of Agriculture.

STAMFORD, Vt., *November 10, 1896.*

The Canandaigua Roads.

I visited Canandaigua to examine the roads constructed by Ira D. Cribb, road commissioner of that town. The roads examined were on the west side of Lake Canandaigua, one running from the city near the lake shore southward, the other parallel to this about one mile to the west.

The roads are constructed of native stone, being a mixture of limestone, bowlders, and field stone. These are broken and placed, some in the middle of the highway and some along the side. Apparently they have been placed on the road without rolling, about seven or eight feet in width. The depth I did not ascertain, but should judge it is from six to eight inches. On the road farthest from the lake there had been considerable repairing recently done. This was done by placing well-broken stone, apparently of better and more uniform quality than the stone used in construction. It had the appearance of being crushed from stone taken from a quarry, but was much more uniform. It was placed loose in the middle of the road, about five feet wide, and about ten inches deep in the center, running to nothing at the edges, which reached the wagon tracks. These roads are fairly good, considering the cheap way in which they were built, and are certainly a great improvement over the dirt roads, which, from the character of the soil, I should judge would be very bad in the winter season after freezing and thawing, the natural soil being a rich, loose loam.

The mode of construction might be improved. It is true the expense would be increased, but when compared to the extra expense for repairs, it would be found on the whole less expensive.

When field stone is used, care should be taken to separate the stone, so as to place that on the surface which wears best and is of a uniform character. The inferior stone should be placed in one course by itself, next to the earth; these two courses should be separately rolled until the stone becomes thoroughly compacted. A little earth might be used on each course, but only enough to fill the interstices. On the last, or surface course, very fine crushed stone, about one-half inch in depth, should be placed and rolled until the surface is smooth, hard, and compact. This would make the road good from the time it is finished; and it will last much longer before needing repairs, and on the whole would be found much less expensive, besides saving a great deal of wear and tear on vehicles of all kinds.

The effect of placing loose stone on roads is, not only discomfort to those who ride, the destruction to the vehicles, and the wear and tear on horses, but it causes the road to become uneven and rough. The wheels, particularly of loaded wagons, are good rollers, and much better when the tires are wide, but they pack the stone irregularly, and only pack it where the wheels go, which, on narrow roads, is pretty much in the same place. In the center of the road, where the horses travel, the stone is loose for a long time, and on the side outside the wagon track the stone never is compacted. The wagon wheels form ruts which hold water, and loose stone lets the water run through to the earth roadbed; this dissolves the earth where it is naturally soft. The stone then settles down into this soft place, making a hollow on the surface of the road; consequently the surface becomes rough and irregular, and wears out fast. Again, after the roadbed becomes soft from water passing through the stone and freezing, the frost raises the stone bed irregularly, and it becomes broken up. It is true that the travel will compact it again, but it will become rough on the surface.

A stone road should be a permanent road, one that is hard, smooth, and fit for use at all times of the year. This can not be had without compacting the broken stone and making the bed water-tight, so that the water will flow to the side ditches, and by them be carried away from the road. If the water is permitted to go through the roadbed, it will never be smooth and hard.

E. G. HARRISON, C. E.,
Special Agent and Road Expert.

Road Repairs and the Cash Tax in Wisconsin, Iowa, and Indiana.

The heaviest tax a farmer pays is the tax of mud roads, over which he is now compelled to haul his produce. We can not have good, hard roads throughout the length and breadth of our State too soon, and this can be accomplished, I believe, when the road taxes are paid in money instead of labor, and that money properly expended.—Lucius Fairchild, ex-Governor of Wisconsin.

In the spring of 1894 our town board reduced the number of road districts to three and appointed three road commissioners. Each commissioner was furnished with a road machine and other tools. The tax was paid in labor, and with better results than under the old system, with numerous road districts. In 1895 the town adopted the cash system, and the result is, we have accomplished more in one year than we could in two years under the old system of working out taxes. The work is much better done. Some of our people think we have accomplished more the past year under the cash system than we did in four years under the old labor system. The town board and a good many others think that we could reduce our road tax one-half and accomplish more under the cash system than we did before, when taxes were worked out.—James Hill, Chairman Town of Baraboo, Wis.

The town of Turtle owns two road graders, which were purchased at the town meeting. We are working our roads under the cash system, which we adopted two years ago. We have three road commissioners, who work under the supervisors, and the condition of our roads has been improved all over the town in a very marked degree. The cash system is very popular in our town, and there is no desire to return to the old, shiftless, unbusiness-like way of working roads. We have not reduced the tax, but the same levy goes nearly twice as far when paid in cash and expended under competent road commissioners.—W. W. Swingle, Chairman Town of Turtle, Rock County, Wis.

We have two road graders in our town and one stone crusher. We have not voted to pay our road tax in money, but have enforced the law of 1893, which provides that road taxes shall be paid in cash unless the town meeting votes to do differently. We used the road money to run the graders; the stone crusher has been run from the incidental fund. We find that we get better results from the cash system; we get about twice as much work done for the same money, and then we have but one system of fixing roads, while before we had as many systems as we had pathmasters. Our road tax is the same in amount as before. The sentiment, as far as I know, is favorable to our present system, and I do not think we will ever return to the old plan. I am an advocate of good roads, and am fully convinced that paying road tax in cash is the right beginning toward better roads. We have to get at one system to make roads, and that, I think, is to macadamize.—Iver Jacobson, Chairman Town of Clinton, Wis.

We consider road machines a perfect success in every particular, and better for saving labor and for keeping the roadbed in condition than any other system adopted yet. We claim that we can build the finest road and make it uniformly good, with the use of a grader, and accomplish more work with one-fourth of the labor than was before required. We certainly do not think of going back to the old system of working roads. We have one grader to four sections of land, or nine in the township. We have not adopted the cash system of road tax. An attempt was made to bring about the cash system, but it failed. The next thing in order was to set aside two-fifths of each man's road tax and assess it to his real and personal property and allow him to work out the remaining three-fifths. The outlook now is, that we could not again organize under the old slush-scraper system. Last year there were over forty miles of road graded in our town, and roads that had not been worked in thirty years, to my knowledge, are now in fine condition. Our road graders work to the satisfaction of 300 taxpayers, and we are in the finest shape for working good roads. The machine we use is the Indiana Reversible.—Evan South, Chairman Town of Jefferson, Green County, Wis.

What we need and should, in my judgment, have, is our road tax paid in money and then expended properly.—James H. Rogers, Desoto, Wis.

I am in favor of paying the road tax in money and limiting the number of road superintendents to two or three in each town.—W. C. Pruyn, Baraboo, Wis.

I am in favor of having the road tax collected in money and expended under the supervision of men who have made the science of road making a study.—S. E. Gernon, Waukesha, Wis.

My experience is in favor of a cash tax and work let to the lowest bidder, and a town board that will not accept the work till it is completed according to contract.—Robert Stewart, Town Supervisor, Eagle River, Wis.

A road tax paid in money is the only way to get good roads in this country, and a liberal donation from both county and State would be beneficial and place us in position to lessen the burden of the sparsely-settled counties.—Francis Cahill, ex-Chairman Town of Ashland, Wis.

I am in favor of having the road tax paid in money and the roads laid out under the supervision of competent engineers and road commissioners.—H. L. Tuttle, Knapp, Wis.

Road working in our county is a day of rest and visiting, and will be so until the cash system is adopted and work let by contract. It is not a question of more tax, but of more work and better methods.—George F. West, President Citizens' National Bank, Darlington, Wis.

Pay road taxes in cash, one hundred cents to the dollar, and have competent men to manage the work.—Oscar A. Spillum, Northcape, Wis.

I think the taxes for road purposes would be paid in money. We have followed this plan in our town for several years and have much better roads than our neighboring towns under the old system of working out their road taxes. Abolish the old system of working out the road tax. Give us a money tax and a limited number of competent overseers, and the improvement in the country roads will be surprising.—F. H. Williams, Whitewater, Wis.

I believe that in order to obtain good roads the tax should be paid in money and laid out on the roads under the supervision of competent commissioners. Road-making days are generally considered as sort of holidays among farmers.—J. T. Stallard, Humbird, Wis.

We adopted the money system in the town of Westport two years ago. We purchased a road grader and we levied a 2-mill road tax instead of a 4-mill tax that we had been paying working the old way. The people are allowed to vote on the question at every election, and they are fully convinced that the cash system is the only true way of getting good roads. There has been more work done on our roads during the last two years than in twenty years before.—Martin J. O'Malley, Chairman Town of Westport, Waunakee Post-office, Wis.

In reply to yours of November 28, I would say that we are well pleased with the cash system of making highways. We have been using this system for three seasons, and find that we can make more and better roads for a 5-mill tax than we could for 7 mills the old way. The board of supervisors appoint the commissioners, and they work under the supervision of the board, as to the amount of money to expend on any one road. We hire our men at \$1.25 per day, a man and team, \$2.50 per day, and work 10 hours per day; our commissioners get \$1.75 per day, and do as good work as any contractor would do. We have a road grader. It is just the thing to make a good road with.—George Wright, Chairman of Alma, Wis.

We adopted the new plan of paying road taxes three years ago. We find by collecting the money and hiring the work done we accomplish much more work than with the tax worked out. We find with the same amount of tax that we have done more in the last three years than we have done before in twice the number of years. We have one road grader and three road commissioners, with about forty miles of public highway divided about equally among the three commissioners. They hire men and teams to work the grader for \$3 per day of 10 hours; then we have the gravel drawn by the yard, and let any taxpayer draw gravel who wishes to and regulate the price according to the distance it is drawn. In three more years we will have our town roads well graded up and graveled. It is a pleasure to drive on our graveled roads in a muddy or wet season.—M. L. Hoffman, Chairman Town of Randall, Kenosha County, Wis.

I agree with Mr. S. D. Hubbard, president of the State agricultural society, that the county should designate some road as a county road to be graded at the expense of the State, county, and town. Let the legislature enact such a law, and pay all road taxes in cash, to be expended under the supervision of practical road builders, and we will soon have good roads.—Henry Schempf, Fort Atkinson, Wis.

If I were the law-making power, I would have the law changed so as to compel the payment of all highway taxes in money, the same as other taxes, and would have the money expended under the direction of a competent overseer. He, of course, would have to hire men and teams, and if any of the farmers had a surplus of help on the farm, let the overseer hire them the same as he would others, and in that way we would get service instead of loafing. I think I am safe in saying that under the old system not more than one road gang in ten goes on the road with the intention of doing good, honest work, but the effort is to see how little they can do and get credit for their time. If the average voter was sufficiently intelligent, or rather honest, he might be trusted with our present plan, but experience has been that when the proposition has been made to reduce the tax one-half and then pay it in money, it is generally voted down.—S. Favill, Madison, Wis.

We worked last year strictly under the new law. Under the old law we always levied a road tax of 4 to 6 mills. Last year we levied 2 mills, as you will see by the inclosed statement. We gave the law a good trial last year and this year we did not vote on it, and of course will work the same as last year. Most of the farmers are well satisfied. We gave them a chance to work at \$3 per day with team, they giving us 10 hours for a day's work. We bought two road graders, which, of course, is what helped us out. You can do more with three teams and one grader in a day than with three teams and a small scraper in a week.

Formerly everybody worked off his tax near home, whether the work was needed or not, only to get the tax worked out that was assessed to him. In the districts where there are good lands, and where a large tax is paid because the land is valued higher, they always have good roads. Under the new law the work is done where it is most needed, so that we can help the poor districts out. Our people have no desire to go back to the old system of working the highway, and never will as long as it is rightly managed.—Wm. F. Pierstorff, Chairman Town of Middleton, Middleton Post-office, Wis.

The town of Turtle, in Rock County, where I reside, was among the first of the several towns in the State to adopt the new road law and the cash system. The town has two of the improved road graders, and each commissioner is given a certain amount of money, so much road to look after, and the use of the grader. In the selection of laborers the farmers are given the preference, and may work out their tax at a stipulated price per day (of 10 hours) for man and team. Each man receives a receipt at the end of his service, which is accepted at face value for taxes.

The system is proving very satisfactory to our people, and our roads are much better than they were three years ago. I do not think our people could ever be induced to go back to the old system. We know that we have spent enough money during the past forty years to have macadamized every foot of road in that time, and until three years ago there had been little or no improvement.—C. H. Everett, ex-President Wisconsin Dairymen's Association, Beloit, Wis.

In 1894 the town of Beloit commenced working under the new road law, and, though the taxation was not increased a single cent, it is conceded by everyone that we have accomplished more in the two years since its adoption than in any ten years under the old slipshod management. This has proved to us that a cash or money tax is one of the first steps in road improvement. In our case it has worked no hardship to anyone, as we have hired the taxpayers to perform this labor if they wished to, subject to the same conditions that govern other kinds of work, paying \$1.50 per day of ten hours for men, and \$3 per day for men and team. The increased amount of work performed and the improved condition of our roads has stimulated and encouraged very many of our people to that degree that we have had several hundred dollars gratuitously given, and offers of more for the coming season, and the better class of our people would not for a moment think of going back to the old system.—A. C. Powers, Chairman Town of Beloit, Wis.

Milton is trying the system of paying road taxes in cash, and \$1 in money judiciously expended is worth \$10 in work as usually done under the old pathmaster system. There are those who kick alike against paying cash or being required to work when paying road taxes. They like the old way of lying in the shade and telling stories most of the time when supposed to work out their road taxes; and they will never walk the "golden streets" if required to pay cash or to work on the road to heaven.—Ezra Goodrich, Milton Junction, Wis.

From a date long prior to the passage of the present road law I have been in favor of paying our road taxes in cash and placing the supervision into the hands of competent persons. So far as practicable, the taxpayers might be hired to do the work and be paid for it in cash, as much as will equal the worth of their labor, and not more. I know of no reason why these requirements may not be met by the new road law. Neither do I know of a reason why we should insist upon working out our road tax, any more than I know of one for demanding the right to work out our school tax. The only objection I can see to the new law is that it admits of local option. It should be made compulsory. Taking everything together, it seems to me that the old, and not the new, law is the unjust one, for more reasons than I have time to write and you to read.—L. E. Scott, Neenah, Wis.

The tax for the improvement of highways should be paid in cash, and the work itself should be paid for in cash, like other work. It is time that an awakening of public sentiment was experienced in Wisconsin, and a great step in advance will be taken when the system of "working out" the road tax is abolished. Then we can look for a solid improvement in our system of road construction.—Editor John Hicks, Oshkosh, Wis.

Under the old road law some districts in most townships worked out their road tax in an intelligent and conscientious manner, while adjoining districts under the notorious time-saving process performed little work, and this at a time and in a manner that accomplished less. The few townships in the State that have accepted the best conditions of the present law raised a money tax and placed the same in the hands of a few level-headed, energetic men to be expended, show results that demonstrate the wisdom of the action. In these instances it has been found that \$1 in money accomplishes as much as \$3 in work. Give us a money tax and a limited number of road overseers who may hold office for a term of years when efficient—in short, apply business principles to this important work and success is assured.—John M. True, Baraboo, Wis.

To pay the road tax in money appears to us farmers a punishment, when in fact it is a benefit and in no wise a change for the worse, for instead of being ordered out by the pathmaster to work on the road, we are being hired by the town, and when our work is done we receive a town order to pay our road tax with to the town treasurer. It is nothing but the old law applied in a more equitable manner. The towns which have adopted the new system seem pleased with it and profess an unwillingness to abandon it. What we condemned in theory they seem to have proved to be good in practice, and the confidence they have shown in themselves and their neighbors has brought them substantial benefits.—Ephraim Beaumont, Hartland, Wis.

While I believe in local self-government just as far as the best interests of a community will permit, I also know that in union there is strength, and therefore feel quite sure, from the reports that come from those townships where the cash system has been given a fair trial in this and other States, that double the results have come, or, in other words, one half the tax will do even better work when expended on the cash basis under a skilled management.—George McKerrow, Sussex, Wis.

The electors of the town of Stanton, in Dunn County, in 1893, after listening to many arguments for and against the system of paying road taxes in money, voted to adopt that system. At the same time they authorized the purchase of a road grader. At the first meeting of the board of supervisors a road grader was purchased and one road commissioner was elected, under whose supervision all road work was performed. At the end of the season it was conceded by all that a greater amount of labor had been put on the roads than during any previous year, and that they were in far better condition than ever before. We had the pleasure of frequently hearing favorable comments on the condition

of our roads, not only from commercial men, but from our neighbors in adjoining towns. The entire amount expended on our roads in 1893 outside of the cost of the road machine was less than \$500, or to be exact, \$483, while in previous years the road tax paid in labor exceeded annually more than \$1,000. So satisfactory was the experiment of paying the road tax in money that in 1894 the electors again voted to continue the plan. In 1895, while a majority agreed that the cash system was by far the best, they voted on account of the pinching times and the great difficulty of getting hold of money, to pay the road tax in labor. The return to the old system, even under conditions that were considered exceptionally favorable to that system, proved anything but profitable. The road tax was more than doubled, and the amount of work actually put on the roads was less than during either of the years under the cash system. The farmer was often called out to work when he could ill afford to leave his crops, and what with inexperienced men and teams working on the road grader the outcome proved expensive and unsatisfactory. If we can judge from the expressions we now hear from the voters, they will at the coming town meeting return to the system of paying the road tax in money. From our experience there is no question that there is a great gain to the taxpayers in paying the road tax in money.—A. R. Hall, Assemblyman, Knapp, Wis.

The law of 1893 will never accomplish the purpose for which it was intended, and is of no benefit to the State. There is too much milk and water in it. It is somewhat like the old New York school law that allowed the school districts to decide by a majority vote whether they would support their schools by a tax upon the taxable property of the district or by a per capita tax. This old law, like our new one, only tended to make turmoil and confusion, and for all practical purposes both are dead letters upon our statutes. I am decidedly of the opinion that the only way to permanently improve our roads will be along the line which we followed when improving our common schools, and that is by raising the entire tax in money. This may meet with some opposition in the newer portions of the State, and appear hard to them, but in the older and more thickly settled parts it will operate with less friction, and everything can be more easily adjusted.—S. D. Hubbard, President State Agricultural Society, Mondovi, Wis.

Good road engineering is a science. It requires a high degree of expert skill to make a good road with a moderate expense. The conclusion must follow that skilled labor must be employed at least for supervision. But skilled labor is costly and requires money to purchase it, hence every municipality must have some money wherewith to procure the supervision required to get good highways. But it may be said, on the other hand, that the average town or road district will not employ expert supervision; that road building is regarded as a kind of playing spell, which every man who lives in the district and pays taxes should have the privilege of enjoying. To the man who reasons thus the argument is unanswerable. He does not regard the construction of a highway as any more difficult than plowing, and his ideal method is to plow up the road or dump it full of earth from the ditches. Whichever method of collection of taxes is used, it must be admitted that there must be an overseer of highways. If he be a man of the latter class, I would prefer to have the highway taxes collected in labor, preferring if the taxes must be largely wasted to have each man enjoy the season of wasting, rather than that one man shall have all the cash and use it to disadvantage. To put the matter in a very brief form: If careful men are elected to direct the use of highway funds, men who have sufficient knowledge of building highways, by all means give them the money to work with. They can hire better help, at times when the work can be done at best advantage, and procure better tools and machinery. One dollar in cash will usually go farther than \$2 in the ordinary highway labor tax. But if such supervision will not be procured, if the expending of the highway tax is to be left to incompetent men, who seek the office of overseer in order to get hold of the funds, whose whole interest is to make the most money with the least possible work, then it is better to adhere to the old system. If you have competent supervision pay your taxes in money; if incompetent supervision pay them in labor. Better waste the labor you do not feel than to waste the cash you do feel, if you must waste at all.—Allen P. Weld, River Falls, Wis.

The town of Hudson did its road work in 1894 under the cash system, with very much less expense, and did much more work for the tax paid. In 1895 the work was done by calling out as usual, putting strange horses and men onto the machines, which can not be done with as good results.—George Martin, Vice-President State Agricultural Society, Hudson, Wis.

I am very much in sympathy with the work for good roads, and trust that the subject will be thoroughly discussed in every township in Wisconsin, so that before long every man in our State will hold up both hands and say: "Give us the law of 1893, but without the loophole through which towns might crawl out. Let everyone pay his road tax in cash, the same as his school tax." The money thus collected should be spent under the direction of the town board through a competent and practical road commissioner, who may keep that office till he proves himself incompetent, or till there is a better man found for the place, that is one who can do better work and more of it; and let the taxpayers have the chance to work on the road for cash provided they will do good work and as much of it as a man who does the work by the job.—H. A. Briggs, Elkhorn, Wis.

As much as ten years ago I became satisfied that the raising of the road tax in money and having it expended under the direction of one competent man would be the means of giving us better roads than we are having under the old system of working out the tax under 20 or 30 different overseers, and that \$1 in cash would do the roads more good than \$3 laid out in the old way. Our town as yet could never be induced to adopt the cash system entirely, but has gradually got into the way of raising a part in money. This has been expended under the direction of the town supervisors, and they have been giving out contracts to improve certain roads to a professional road maker.

The one mill on the dollar we sometimes raised and expended in this way accomplished more permanent good than did the two and a-half or three mills worked out under the twenty-nine road commissioners, one of whom was appointed in each of the old road districts. This is in the town of Oakland, Jefferson County, where I, until recently, have lived, and where I still own a farm.

The reform is coming slowly, but it is nevertheless coming, if we but keep up the agitation. The old annual road-working "picnic" will in a few years be a thing of the past, and if we then should not have so much fun working the roads, we will have more pleasure in traveling them in quicker time and with heavier loads. This will have the effect to bring our farms nearer to the market towns, and will increase the value of every acre.

My farm lies nine miles from town. It would be worth \$5 an acre more if it were moved to half the distance. If the road were so improved that I could haul twice as large a load as now, and travel over it when not loaded in half the time, and be able to go with ease in all kinds of weather, no matter how wet, it would amount to the same thing. And since my farm can not be moved, I am anxious to do the next best thing, that is to raise the value of the land by making a good road.—C. F. Goodrich, Fort Atkinson, Wis.

We believe the road law of 1879 was a move in the right direction, in providing for the cash payment of taxes. An experience of four years as town chairman justifies me in saying that straight, honest road work is assured by this system, leaving no "kickers" after it, only those whose habit it was to dodge both the work and the tax. By all means encourage the towns to adopt the new system. We have tried it two years, and the roads of our town show it.—Salmon Brown, Chairman Town of Newport, Kilbourn City, Wis.

Roads should be placed under the supervision of skillful men, and money paid for the work the same as for any other. Imagine how long it would take to build a railroad under the old system of working roads, and then we can get an idea how long it will take us to get good wagon roads if we adhere to that system.

All intelligent men know that the old system has proved a failure and that wherever the money system has been given a fair trial it has proved very satisfactory.—A. A. Arnold, Galesville, Wis.

I am in favor of having the road tax paid in money and the roads laid out under the supervision of competent engineers and road commissioners. Living, as I do, twenty-three miles from Milwaukee, and being engaged in truck farming, I know from personal experience and from that of my neighbors that we are in great need of better roads. The time is not far distant when a farmer at Janesville just after breakfast will mount his wagon, which is loaded with 100 bushels of potatoes, run to Milwaukee, sell his load, and arrive home in time for his supper. He will do this and more when the roads are in an improved condition and when he is in possession of the improved road wagons which are now being constructed. Let the good work go on.—L. C. Word, Caldwell, Wis.

I have had no experience with the cash system of road making, as that system was voted down at our town election of 1893. But I think it would not have been voted down if the people had better understood what they were doing. They believed that if they paid their taxes in money, the money, if spent on roads at all, would be spent outside of their own district, and perhaps out of their town or county.

I am satisfied that we will never have good roads until the cash system is adopted; if that is done, I am sure that with but one-third of the amount now supposed to be paid in labor we would have more and better work done than we now have with the present system.

I, for one, and several of my friends and neighbors think the same way, had rather pay our tax in money than in labor. For when the time comes to work, we would not have to go if our time was worth more to us at home. And if a portion of us did not care to work, there would always be enough men glad to work if they were sure of getting pay for it.

I am living in the town of Trenton, Dodge County. The roads here are but little better than they were twenty years ago, and if we keep on with the present system, I am sure they will not be better twenty years hence. So I say, let us do something to better the condition of our roads and do it as soon as possible.—Charles Thorpe, Burnett Junction, Wis.

We have not had any experience with the cash system in our town. But I believe that to be the right way to collect highway tax, and am glad to know that public sentiment is rapidly tending in that direction. I am convinced that more and better work can be done with \$1 paid in money than has usually been done with \$1.50 paid in labor. Not that it is impossible to do just as much by the labor system, but the fact is that it never has been done.

I know well enough that money can be squandered on roads as well as anywhere else. But there is this difference, that we are more likely to keep our eyes open when we pay money for a certain purpose, and demand to see the equivalent for what we have spent. Town officers, as a rule, are held to strict account for the manner in which they have disbursed the public funds. But who has ever been called to account for squandering the labor tax?

The State has committed to the citizens of the town two great systems, that of the common schools and that of the highways. On the proper maintenance of these depend the intelligence, wealth, and general welfare of the commonwealth. It is in the power of the citizens to make either, or both, good, bad, or indifferent.

I wonder it has never occurred to our labor-loving taxpayers to demand the privilege of working out the school tax. Why not? Mr. A., who has a large tax, could teach the school for four weeks, Mr. B. could work out his in two weeks, and Mr. C. could teach out his in three days. D. and E. could haul fuel, and M. F. could prepare it. There would be some advantage in this system. If Mr. A. should be ill, or have business in town, he could send his boy or his hired man to teach in his place. Of course, the school would not make the progress that it does under the management of one competent teacher, but the tax would be paid, and the result, as a whole, would not be worse than that obtained under the present system of working out the road taxes for the bettering of the roads. The two cases are parallel in many respects.

The good roads discussion is bearing good fruit. There is, all abroad, a growing sentiment in favor of improved roads, and this sentiment will demand proper methods. In the meanwhile, let the agitation of the subject go on.—George C. Hill, Rosendale, Wis.

I think we have in the town of Rudolph the best roads in Wood County, because we want good roads. We are liberal in voting a special tax every year for said purpose, and the balance of the road tax is levied by the old custom. I prefer the system under the new law, and would like to see it enforced hereafter.—Ferdinand Phillips, Chairman Town of Rudolph, Wis.

The cash tax is the true way out of the woods on this road question. We never will have roads until this is universally practiced. It need not be a bugbear of a tax either. I would suggest that after the tax is levied and collected, such of the farmers as were willing to work for going wages, and will do as much work as they are paid for, should be hired in their own towns. But this matter should be left with the road commissioners. There is no doubt that twice as much would be done, and being under a good man, the work would be more intelligently done.—W. N. Johnson, Pathmaster, Oxford, Wis.

I believe there has been more good work done in this county in the last three years than in the six years preceding. When the new law went into effect in our town we voted to pay the tax in cash and have one overseer instead of nine, as before. We worked in this way two years, but found that one overseer with one crew could not keep all the bad places patched, and in a few cases work was neglected too long, costing more to repair than if taken in time. So last year we had four overseers looking after about ten or twelve miles each, and find this works well, as the work is done early in the season, and on prairie soils we find that work done in May is better than in July. The overseers are allowed to hire farmers who will do good work, paying them with a town order, which will apply on their taxes. The overseers have had no trouble in getting good work done under the cash system. I think the new law just passed allowing a vote to pay in labor is a step backwards, for the overseer will not be able to do as good work, as there are many renters who are obliged by contracts to work the road tax on the farms they occupy who take no interest in the work, but will now be allowed to go on and put in time as of old. Almost every town in our county has one or more graders and they are doing work at one-third the cost of the old method. Keep up the good work and the roads will continue to grow better.—W. C. Bradley, Hudson, Wis.

I am not opposed to paying road taxes in money, but believe that no road law enacted will become efficient that does not prescribe the manner by which and the material of which the roads shall be built. The Good Roads League is accomplishing wonderful work in arousing the public mind to the absolute necessity of bettering the condition of our public roads.—Thomas H. Mosher, Kneeland, Wis.

I, for one, would like to pay road taxes in cash, as I know we can get better roads that way. Our roads are very bad and no better than they were fifteen years ago. I hope the league for good roads can do something to get the farming classes to see the necessity of better roads.—A. M. Turgason, Town Chairman, Fivepoints, Wis.

No subject which has come before the legislature in the two terms I have served has been of so much importance as the one how to get rid of the old moss-back system of levying road taxes, and the old 1849 districts. It has been a source of much left-handed delight to me to see how the average member will persist in thinking that the farmer still wants to work out the road taxes and drive to town in the mud. Kill the average politician, or convince him that he misrepresents the farmer when he claims they are not in favor of a better tax system and better roads, and the problem is solved.—Wm. O'Neil, Assemblyman, Washburn, Wis.

Personally, I should prefer the cash method, and have worked toward that end; yet, we were outvoted three to one in our town. The agitation which ensued was beneficial, however, and probably 100 per cent better work has been done since the 1893 law came into effect in our township. It matters little which method is used, providing the work is in charge of competent men and honest labor is obtained. Necessary machinery is an absolute necessity. No private undertaking would for a moment be prosecuted with the lack of appliances that has been characteristic of the public's attempts at road building. Many a farmer will have \$1,000 worth of tools to work his farm and yet object to his town's owning half as many dollars' worth for all of the road work of the township. It would be as consistent to employ a carpenter to build a barn and furnish him a tack hammer with which to drive nails.—F. J. Frost, Almond, Wis.

This town has worked on the cash basis since it was organized. There are so few settlers in our town that the old way of working out road taxes would not pay us. I am sure the cash basis is the best. We have a grader in our town, and it certainly saves 50 per cent of labor, if not more.—J. E. Anderson, Chairman Town of Crandon, Wis.

Our county has been working to obtain good roads since 1888. We are able to accomplish more by the cash system than by the old system of working out the taxes, although we have increased our town and county taxes some, due to the fact that annually we construct many new roads, besides trying to improve and maintain the old ones. The people here think favorably of the new system and recommend it for the future.—W. D. Cornagey, Chairman Town of Pelican-lake, Wis.

Our town has always collected its road tax in cash since its organization, and for the past three years has hired nearly all labor by the day and had the work done by an overseer of highways under general instructions from the town board. Prior to this time the work was let largely by contract to lowest bidder, but we find the day work more satisfactory in that we get better and more work for the money expended. Our town never had any road machinery except scrapers and plows till this season. Last spring we purchased a stump puller and a champion steel road grader, and I do not exaggerate when I say we can build turnpike roads with this grader for one-tenth the cost under the old system of plow and scraper. We have not reduced the amount of our road taxes. All our people like the cash system. Our town is ten years old, but never got any gravel onto our roads till this year. But this year with our road machine we have made narrow turnpike on eight or ten miles of road and covered about one and one-half miles with gravel. I say by all means have the cash system of road tax, and remember you can not build roads without money.—F. S. Campbell, Chairman Town of Gagen, Wis.

The board of supervisors and other county officers of the counties constituting the First Iowa Congressional district assembled in this city Tuesday for a two days' session. Upon motion of Mr. R. D. Du Bois, of Jefferson County, the following committee was appointed to draft a resolution to ask the legislators of the different counties of the district to present to the State legislature a bill for a change in the mode of collecting road taxes and the working of the public highways. The motion was adopted unanimously, and the following committee was appointed: R. D. Du Bois, J. F. Daugherty, Sol. Cavenuee.

The committee reported as follows:

Gentlemen: Your committee, appointed to recommend a change in the collection of township road tax, would respectfully recommend the following:

That the board of township trustees of every township in each county shall, at their regular April session, determine the amount of taxes necessary for improvement of roads in their respective townships for the year following, which amount so fixed shall be certified to the board of supervisors, who shall levy the amount so certified, and order the same placed on the tax books of the county, and the county treasurer shall collect the same, as other taxes, without charging a commission therefor, and shall pay the same over to the township clerk upon order of the chairman of the board of trustees of the respective townships. The money thus collected shall be expended on the highways of the respective townships under the supervision of the township trustees. [This resolution passed unanimously.]—Burlington, Iowa, Hawkeye, November 19, 1896.

Resolved, That all road taxes should be paid in cash, as experience has shown that several times the usual amount of work has been accomplished where this plan has been in force in place of the old system of working out road taxes.—Farmers' National Congress, Indianapolis, November 12, 1896.

United States Department of Agriculture, OFFICE OF ROAD INQUIRY.

HIGHWAY MAINTENANCE AND REPAIRS.

Highway Taxation; Comparative Results of Labor and Money Systems; Contract System of Maintaining Roads.

Practical Results of the Daily Care of Common Roads.

Being interested in the subject of good roads and studying the matter from a practical standpoint, I became convinced that prevailing methods were very extravagant and ineffectual to accomplish the best results in furnishing to the public satisfactory roads. The system requiring a pathmaster, or surveyor, in each neighborhood to warn out the inhabitants once a year at a convenient season and go over the roads of the town to repair the damages caused by neglecting them all the rest of the year is not well adapted to this business-like age.

The ordinary country roads do not wear out; they wash out and freeze out. Water is the great road destroying element. This should be recognized in the maintenance of roads as well as in their construction. The action of water and mud, which is water and the road material mixed, upon the road surface are the chief causes of poor and unsatisfactory roads. The damage caused by water on the road surface can be prevented by maintaining at intervals properly constructed water bars, or mounds, more or less elevated, according to the incline or slope of the surface, with water courses always kept open to carry away the water where it will do no damage.

Muddy roads are prevented by excluding the water. Wherever water stands upon the road or in pools beside the road during the fall months, there we have the troublesome mud. The roadbed being perfectly saturated, the process of freezing separates each particle of material from every other particle. The thawing process gives the mud. All this can be prevented by getting rid of the water.

Ordinarily the chief work done by country people on highways is repairing the damage consequent upon neglect. Why this neglect? Simply because the people are trying to follow old, obsolete methods poorly adapted to these times of intense business energy and economy.

Much may be learned from the methods employed in maintaining the railroads. The means adopted to keep up our highways would be considered extravagant for them. The principle of economy forces them to a better system—one of constant and continuous work of repairing.

In the spring of 1894, with the purpose of adopting better methods for road management, I asked the people of my town for the office of road commissioner, and being elected to that office, I proceeded to institute a system of continuous inspection and repairs. Being familiar with all the roads of the town, and the uses to which they are put, I divided them into sections and made choice of the men who should have charge of and keep each section. My next task was to see other men and endeavor to enthuse each with some spirit of improvement. They were reminded that the value of their farms depended upon the condition of the road. They were assured that the roads were to be improved, and urged to use their best endeavors in inaugurating reform in our methods of road management.

Each man was furnished with a good, new shovel and a pass book in which to charge for each and every hour he spent upon the road. He was instructed to go over his section as soon as the ground was bare of snow, or as soon as the water

began to flow; to see to it that the water was kept off the road; to go over the road every day if necessary while the snow was going and during the rainy season, for it is then that the most damage is done; and that when so passing over the road he should remedy all slight defects where a few shovelfuls of earth or gravel would prevent a bad mud hole later on. These men were told that the old way of working the road once a year had been abandoned, and that it was expected that a few hours' work each week, when it would not seriously interfere with their farm work, would accomplish all that was expected.

The main road through the town, six miles long, not only takes the travel of the other roads, but is the thoroughfare by which the inhabitants of other towns reach the city with their produce, lumber, wood, and a great deal of heavy trucking. The best farmers live along this road and have enough business of their own without caring for a section of road. Because of this, and for various other reasons, I conceived the idea of employing one man to keep this road, and therefore engaged a faithful man with his horse, the town furnishing a cart.

He was employed from spring till fall, and his instructions were to begin at one end and work one mile each day, covering the entire route each week, and fixing the worst mud holes (and there were many), using the best road material at hand; and at the close of each day to pass over the mile worked, gathering the loose stones, putting them where they would give no more trouble.

I will say here that the maintenance of this road was and had been a great burden to the town, and its condition was far from satisfactory to the traveling public. When the man employed learned what was expected of him, he shrank from the task, saying, "What can I do to keep this road when a large gang of men with great expense has failed to keep it?" He was only persuaded to make the attempt by the assurance that the responsibility and any bad results would rest on the commissioner.

There was much ridicule and prejudice against this system of management for a time. The man employed was instructed not to participate in any discussion of the subject, not to answer questions relative to the road or his work upon it, and to refrain from talking about the matter generally on penalty of being discharged. Other people talked and ridiculed, but the work went on, and after a few weeks the condition of the road improved, and people noticed the fact. They also discovered that the expense was not large; that all the work done was remedying defects and at the same time preventing greater ones. And so the work went on and prejudice died out. At the next annual town meeting the people without opposition continued the system, and at the last town meeting elected the road commissioner for three years with the same system of road management.

The general results are that much better roads are secured at less expense, and the tax rate for highways has been reduced each year, as the roads grew better, and as we learned to maintain them free from damage at less cost.

I will say we do something more for the roads than is here indicated. What we do is for maintaining or holding them, and at the same time improving. But these roads should be built according to modern ideas of road construction; so we set apart a portion of the road fund for permanent improvement, building up each year a piece or section of the main road in a thorough manner and of good material, and constructing culverts of stone in a permanent way. After the road is put in good condition one man can easily keep and care for a long stretch.

Very truly yours,

J. O. SANFORD,
Vermont Board of Agriculture.

STAMFORD, VT., November 10, 1896.

The Canandaigua Roads.

I visited Canandaigua to examine the roads constructed by Ira D. Cribb, road commissioner of that town. The roads examined were on the west side of Lake Canandaigua, one running from the city near the lake shore southward, the other parallel to this about one mile to the west.

The roads are constructed of native stone, being a mixture of limestone, bowlders, and field stone. These are broken and placed, some in the middle of the highway and some along the side. Apparently they have been placed on the road without rolling, about seven or eight feet in width. The depth I did not ascertain, but should judge it is from six to eight inches. On the road farthest

from the lake there had been considerable repairing recently done. This was done by placing well-broken stone, apparently of better and more uniform quality than the stone used in construction. It had the appearance of being crushed from stone taken from a quarry, but was much more uniform. It was placed loose in the middle of the road, about five feet wide, and about ten inches deep in the center, running to nothing at the edges, which reached the wagon tracks. These roads are fairly good, considering the cheap way in which they were built, and are certainly a great improvement over the dirt roads, which, from the character of the soil, I should judge would be very bad in the winter season after freezing and thawing, the natural soil being a rich, loose loam.

The mode of construction might be improved. It is true the expense would be increased, but, when compared to the extra expense for repairs, it would be found on the whole less expensive.

When field stone is used, care should be taken to separate the stone, so as to place that on the surface which wears best and is of a uniform character. The inferior stone should be placed in one course by itself, next to the earth. These two courses should be separately rolled until the stone becomes thoroughly compacted. A little earth might be used on each course, but only enough to fill the interstices. On the last, or surface course, very fine crushed stone, about one-half inch in depth, should be placed and rolled until the surface is smooth, hard, and compact. This would make the road good from the time it is finished, and it will last much longer before needing repairs, and on the whole would be found much less expensive, besides saving a great deal of wear and tear on vehicles of all kinds.

The effect of placing loose stone on roads is, not only discomfort to those who ride, the destruction of the vehicles, and the wear and tear on horses, but it causes the road to become uneven and rough. The wheels, particularly of loaded wagons, are good rollers, and much better when the tires are wide, but they pack the stone irregularly, and only pack it where the wheels go, which, on narrow roads, is pretty much in the same place. In the center of the road, where the horses travel, the stone is loose for a long time, and on the side outside the wagon track the stone never is compacted. The wagon wheels form ruts which hold water, and loose stone lets the water run through to the earth roadbed; this dissolves the earth where it is naturally soft. The stone then settles down into this soft place, making a hollow on the surface of the road; consequently the surface becomes rough and irregular, and wears out fast. Again, after the roadbed becomes soft from water passing through the stone and freezing, the frost raises the stone bed irregularly, and it becomes broken up. It is true that the travel will compact it again, but it will become rough on the surface.

A stone road should be a permanent road—one that is hard, smooth, and fit for use at all times of the year. This can not be had without compacting the broken stone and making the bed water-tight, so that the water will flow to the side ditches, and by them be carried away from the road. If the water is permitted to go through the roadbed, it will never be smooth and hard.

E. G. HARRISON, C. E.,
Special Agent and Road Expert.

Highway Taxation.

The heaviest tax a farmer pays is the tax of mud roads over which he is now compelled to haul his produce. We can not have good, hard roads throughout the length and breadth of our State too soon, and this can be accomplished, I believe, when the road taxes are paid in money instead of labor, and that money properly expended.—Lucius Fairchild, ex-Governor of Wisconsin.

In the spring of 1894 our town board reduced the number of road districts to three and appointed three road commissioners. Each commissioner was furnished with a road machine and other tools. The tax was paid in labor, and with better results than under the old system, with numerous road districts. In 1895 the town adopted the cash system, and the result is, we have accomplished more in one year than we could in two years under the old system of working out taxes. The work is much better done. Some of our people think we have accomplished more the past year under the cash system than we did in four years under the old labor

system. The town board and a good many others think that we could reduce our road tax one-half and accomplish more under the cash system than we did before, when taxes were worked out.—James Hill, Chairman Town of Baraboo, Wis.

The town of Turtle owns two road graders, which were purchased at the town meeting. We are working our roads under the cash system, which we adopted two years ago. We have three road commissioners, who work under the supervisors, and the condition of our roads has been improved all over the town in a very marked degree. The cash system is very popular in our town, and there is no desire to return to the old, shiftless, unbusiness-like way of working roads. We have not reduced the tax, but the same levy goes nearly twice as far when paid in cash and expended under competent road commissioners.—W. W. Swingle, Chairman Town of Turtle, Rock County, Wis.

We have two road graders in our town and one stone crusher. We have not voted to pay our road tax in money, but have enforced the law of 1893, which provides that road taxes shall be paid in cash unless the town meeting votes to do differently. We used the road money to run the graders; the stone crusher has been run from the incidental fund. We find that we get better results from the cash system; we get about twice as much work done for the same money, and then we have but one system of fixing roads, while before we had as many systems as we had pathmasters. Our road tax is the same in amount as before. The sentiment, as far as I know, is favorable to our present system, and I do not think we will ever return to the old plan. I am an advocate of good roads, and am fully convinced that paying road tax in cash is the right beginning toward better roads. We have to get at one system to make roads, and that, I think, is to macadamize.—Iver Jacobson, Chairman Town of Clinton, Wis.

What we need and should, in my judgment, have, is our road tax paid in money and then expended properly.—James H. Rogers, Desoto, Wis.

I am in favor of paying the road tax in money and limiting the number of road superintendents to two or three in each town.—W. C. Pruyn, Baraboo, Wis.

I am in favor of having the road tax collected in money and expended under the supervision of men who have made the science of road making a study.—S. E. Gernon, Waukesha, Wis.

My experience is in favor of a cash tax and work let to the lowest bidder, and a town board that will not accept the work till it is completed according to contract.—Robert Stewart, Town Supervisor, Eagle River, Wis.

A road tax paid in money is the only way to get good roads in this country, and a liberal donation from both county and State would be beneficial and place us in a position to lessen the burden of the sparsely settled counties.—Francis Cahill, ex-Chairman Town of Ashland, Wis.

I am in favor of having the road tax paid in money and the roads laid out under the supervision of competent engineers and road commissioners.—H. L. Tuttle, Knapp, Wis.

Road working in our county is a day of rest and visiting, and will be so until the cash system is adopted and work let by contract. It is not a question of more tax, but of more work and better methods.—George F. West, President Citizens' National Bank, Darlington, Wis.

Pay road taxes in cash, one hundred cents to the dollar, and have competent men to manage the work.—Oscar A. Spillum, Northcape, Wis.

I think the taxes for road purposes should be paid in money. We have followed this plan in our town for several years and have much better roads than our neighboring towns under the old system of working out their road taxes. Abolish the old system of working out the road tax. Give us a money tax and a limited number of competent overseers, and the improvement in the country roads will be surprising.—F. H. Williams, Whitewater, Wis.

I believe that in order to obtain good roads the tax should be paid in money and laid out on the roads under the supervision of competent commissioners. Road-making days are generally considered as a sort of holidays among farmers.—J. T. Stallard, Humbird, Wis.

We adopted the money system in the town of Westport two years ago. We purchased a road grader and we levied a 2-mill road tax instead of a 4-mill tax that we had been paying working the old way. The people are allowed to vote on the question at every election, and they are fully convinced that the cash system is the only true way of getting good roads. There has been more work done on our roads during the last two years than in twenty years before.—Martin J. O'Malley, Chairman Town of Westport, Waunakee Post-office, Wis.

In reply to yours of November 28, I would say that we are well pleased with the cash system of making highways. We have been using this system for three seasons, and find that we can make more and better roads for a 5-mill tax than we could for 7 mills the old way.—George Wright, Chairman of Alma, Wis.

We adopted the new plan of paying road taxes three years ago. We find by collecting the money and hiring the work done we accomplish much more work than with the tax worked out. We find with the same amount of tax that we have done more in the last three years that we have done before in twice the number of years. We have one road grader and three road commissioners, with about 40 miles of public highway divided about equally among the three commissioners. They hire men and teams to work the grader for \$3 per day of ten hours; then we have the gravel drawn by the yard, and let any taxpayer draw gravel who wishes to and regulate the price according to the distance it is drawn. In three more years we will have our town roads well graded up and graveled. It is a pleasure to drive on our graveled roads in a muddy or wet season.—M. L. Hoffman, Chairman Town of Randall, Kenosha County, Wis.

I agree with Mr. S. D. Hubbard, president of the State agricultural society, that the county should designate some road as a county road to be graded at the expense of the State, county, and town. Let the legislature enact such a law, and pay all road taxes in cash, to be expended under the supervision of practical road builders, and we will soon have good roads. Henry Schempf, Fort Atkinson, Wis.

We worked last year strictly under the new law. Under the old law we always levied a road tax of 4 to 6 mills. Last year we levied 2 mills, as you will see by the inclosed statement. We gave the law a good trial last year and this year we did not vote on it, and of course will work the same as last year. Most of the farmers are well satisfied. We gave them a chance to work at \$3 per day with team, they giving us 10 hours for a day's work. We bought two road graders, which, of course, is what helped us out. You can do more with three teams and one grader in a day than with three teams and a small scraper in a week.

Formerly everybody worked off his tax near home, whether the work was needed or not, only to get the tax worked out that was assessed to him. In the districts where there are good lands, and where a large tax is paid because the land is valued higher, they always have good roads. Under the new law the work is done where it is most needed, so that we can help the poor districts out. Our people have no desire to go back to the old system of working the highway, and never will as long as it is rightly managed.—Wm. F. Pierstorff, Chairman Town of Middleton, Middleton Post-office, Wis.

The town of Turtle, in Rock County, where I reside, was among the first of the several towns in the State to adopt the new road law and the cash system. The town has two of the improved road graders, and each commissioner is given a certain amount of money, so much road to look after, and the use of the grader. In the selection of laborers the farmers are given the preference, and may work out their tax at a stipulated price per day (of 10 hours) for man and team. Each man receives a receipt at the end of his service, which is accepted at face value for taxes.

The system is proving very satisfactory to our people, and our roads are much better than they were three years ago. I do not think our people could ever be induced to go back to the old system. We know that we have spent enough money during the past forty years to have macadamized every foot of road in that time, and until three years ago there had been little or no improvement.—C. H. Everett, ex-President Wisconsin's Dairy Association, Beloit, Wis.

In 1894 the town of Beloit commenced working under the new road law, and, though the taxation was not increased a single cent, it is conceded by everyone that we have accomplished more in the two years since its adoption than in any ten years under the old slipshod management. This has proved to us that a cash or money tax is one of the first steps in road improvement. In our case it has worked no hardship to anyone, as we have hired the taxpayers to perform this

labor if they wished to, subject to the same conditions that govern other kinds of work, paying \$1.50 per day of ten hours for men, and \$3 per day for men and team. The increased amount of work performed and the improved condition of our roads has stimulated and encouraged very many of our people to that degree that we have had several hundred dollars gratuitously given, and offers of more for the coming season, and the better class of our people would not for a moment think of going back to the old system.—A. C. Powers, Chairman Town of Beloit, Wis.

Milton is trying the system of paying road taxes in cash, and \$1 in money judiciously expended is worth \$10 in work as usually done under the old pathmaster system. There are those who kick alike against paying cash or being required to work when paying road taxes. They like the old way of lying in the shade and telling stories most of the time when supposed to work out their road taxes; and they will never walk the "golden streets" if required to pay cash or to work on the road to heaven.—Ezra Goodrich, Milton Junction, Wis.

From a date long prior to the passage of the present road law I have been in favor of paying our road taxes in cash and placing the supervision into the hands of competent persons. So far as practicable, the taxpayers might be hired to do the work and be paid for it in cash, as much as will equal the worth of their labor, and not more. I know of no reason why these requirements may not be met by the new road law. Neither do I know of a reason why we should insist upon working out our road tax, any more than I know of one for demanding the right to work out our school tax. The only objection I can see to the new law is that it admits of local option. It should be made compulsory. Taking everything together, it seems to me that the old, and not the new, law is the unjust one, for more reasons than I have time to write and you to read.—L. E. Scott, Neenah, Wis.

Under the old road law some districts in most townships worked out their road tax in an intelligent and conscientious manner, while adjoining districts under the notorious time-saving process performed little work, and this at a time and in a manner that accomplished less. The few townships in the State that have accepted the best conditions of the present law raised a money tax and placed the same in the hands of a few level-headed, energetic men to be expended, show results that demonstrate the wisdom of the action. In these instances it has been found that \$1 in money accomplishes as much as \$3 in work. Give us a money tax and a limited number of road overseers who may hold office for a term of years when efficient. In short, apply business principles to this important work and success is assured.—John M. True, Baraboo, Wis.

To pay the road tax in money appears to us farmers a punishment, when in fact it is a benefit and in no wise a change for the worse; for, instead of being ordered out by the pathmaster to work on the road, we are being hired by the town, and when our work is done we receive a town order to pay our road tax with to the town treasurer. It is nothing but the old law applied in a more equitable manner. The towns which have adopted the new system seem pleased with it and profess an unwillingness to abandon it. What we condemned in theory they seem to have proved to be good in practice, and the confidence they have shown in themselves and their neighbors has brought them substantial benefits.—Ephraim Beaumont, Hartland, Wis.

The electors of the town of Stanton, in Dunn County, in 1893, after listening to many arguments for and against the system of paying road taxes in money, voted to adopt that system. At the same time they authorized the purchase of a road grader. At the first meeting of the board of supervisors a road grader was purchased and one road commissioner was elected, under whose supervision all road work was performed. At the end of the season it was conceded by all that a greater amount of labor had been put on the roads than during any previous year, and that they were in far better condition than ever before. We had the pleasure of frequently hearing favorable comments on the condition of our roads, not only from commercial men, but from our neighbors in adjoining towns. The entire amount expended on our roads in 1893 outside of the cost of the road machine was less than \$500, or to be exact, \$483, while in previous years the road tax paid in labor exceeded annually more than \$1,000. So satisfactory was the experiment of paying the road tax in money that in 1894 the electors again voted to continue the plan. In 1895, while a majority agreed that the cash system was by far the best, they voted on account of the pinching times and the great difficulty of getting hold of money, to pay the road tax in labor. The return

to the old system, even under conditions that were considered exceptionally favorable to that system, proved anything but profitable. The road tax was more than doubled, and the amount of work actually put on the roads was less than during either of the years under the cash system. The farmer was often called out to work when he could ill afford to leave his crops, and what with inexperienced men and teams working on the road grader the outcome proved expensive and unsatisfactory. If we can judge from the expressions we now hear from the voters, they will at the coming town meeting return to the system of paying the road tax in money. From our experience there is no question that there is a great gain to the taxpayers in paying the road tax in money.—A. R. Hall, Assemblyman, Knapp, Wis.

The law of 1893 will never accomplish the purpose for which it was intended, and is of no benefit to the State. There is too much milk and water in it. It is somewhat like the old New York school law that allowed the school districts to decide by a majority vote whether they would support their schools by a tax upon the taxable property of the district or by a per capita tax. This old law, like our new one, only tended to make turmoil and confusion, and for all practical purposes both are dead letters upon our statutes. I am decidedly of the opinion that the only way to permanently improve our roads will be along the line which we followed when improving our common schools, and that is by raising the entire tax in money. This may meet with some opposition in the newer portions of the State, and appear hard to them, but in the older and more thickly settled parts it will operate with less friction, and everything can be more easily adjusted.—S. D. Hubbard, President State Agricultural Society, Mondovi, Wis.

Good road engineering is a science. It requires a high degree of expert skill to make a good road with moderate expense. The conclusion must follow that skilled labor must be employed, at least for supervision. But skilled labor is costly and requires money to purchase it, hence every municipality must have some money wherewith to procure the supervision required to get good highways. But it may be said, on the other hand, that the average town or road district will not employ expert supervision; that road building is regarded as a kind of playing spell, which every man who lives in the district and pays taxes should have the privilege of enjoying. To the man who reasons thus the argument is unanswerable. He does not regard the construction of a highway as any more difficult than plowing, and his ideal method is to plow up the road or dump it full of earth from the ditches. Whichever method of collection of taxes is used, it must be admitted that there must be an overseer of highways. If he be a man of the latter class, I would prefer to have the highway taxes collected in labor, preferring if the taxes must be largely wasted to have each man enjoy the season of wasting, rather than that one man shall have all the cash and use it to disadvantage. To put the matter in a very brief form: If careful men are elected to direct the use of highway funds, men who have sufficient knowledge of building highways, by all means, give them the money to work with. They can hire better help, at times when the work can be done at best advantage, and procure better tools and machinery. One dollar in cash will usually go further than \$2 in the ordinary highway labor tax. But if such supervision will not be procured, if the expending of the highway tax is to be left to incompetent men who seek the office of overseer in order to get hold of the funds, whose whole interest is to make the most money with the least possible work, then it is better to adhere to the old system. If you have competent supervision, pay your taxes in money; if incompetent supervision, pay them in labor. Better waste the labor you do not feel than to waste the cash you do feel, if you must waste at all.—Allen P. Weld, River Falls, Wis.

I am very much in sympathy with the work for good roads, and trust that the subject will be thoroughly discussed in every township in Wisconsin, so that before long every man in our State will hold up both hands and say: "Give us the law of 1893, but without the loophole through which towns might crawl out. Let everyone pay his road tax in cash, the same as his school tax." The money thus collected should be spent under the direction of the town board through a competent and practical road commissioner, who may keep that office till he proves himself incompetent, or till there is a better man found for the place, that is, one who can do better work and more of it; and let the taxpayers have the chance to work on the road for cash, provided they will do good work and as much of it as a man who does the work by the job.—H. A. Briggs, Elkhorn, Wis.

The town of Hudson did its road work in 1894 under the cash system, with very much less expense, and did much more work for the tax paid. In 1895 the work was done by calling out as usual, putting strange horses and men onto the machines, which can not be done with as good results.—George Martin, Vice-President State Agricultural Society, Hudson, Wis.

As much as ten years ago I became satisfied that the raising of the road tax in money and having it expended under the direction of one competent man would be the means of giving us better roads than we are having under the old system of working out the tax under twenty or thirty different overseers, and that \$1 in cash would do the roads more good than \$3 laid out in the old way. Our town as yet could never be induced to adopt the cash system entirely, but has gradually got into the way of raising a part in money. This has been expended under the direction of the town supervisors, and they have been giving out contracts to improve certain roads to a professional road maker.

The 1 mill on the dollar we sometimes raised and expended in this way accomplished more permanent good than did the two and a half or three mills worked out under the twenty-nine road commissioners, one of whom was appointed in each of the old road districts. This is in the town of Oakland, Jefferson County, where I, until recently, have lived, and where I still own a farm.

The reform is coming slowly, but it is nevertheless coming, if we but keep up the agitation. The old annual road-working "picnic" will, in a few years, be a thing of the past, and if we then should not have so much fun working the roads, we will have more pleasure in traveling them in quicker time and with heavier loads. This will have the effect to bring our farms nearer to the market towns, and will increase the value of every acre.

My farm lies 9 miles from town. It would be worth \$5 an acre more if it were moved to half the distance. If the roads were so improved that I could haul twice as large a load as now, and travel over it when not loaded in half the time, and be able to go with ease in all kinds of weather, no matter how wet, it would amount to the same thing. And since my farm can not be moved, I am anxious to do the next best thing, that is, to raise the value of the land by making a good road.—C. F. Goodrich, Fort Atkinson, Wis.

We believe the road law of 1879 was a move in the right direction, in providing for the cash payment of taxes. An experience of four years as town chairman justifies me in saying that straight, honest road work is assured by this system, leaving no "kickers" after it, only those whose habit it was to dodge both the work and the tax. By all means encourage the towns to adopt the new system. We have tried it two years, and the roads of our town show it.—Salmon Brown, Chairman Town of Newport, Kilbourn City, Wis.

Roads should be placed under the supervision of skillful men, and money paid for the work the same as for any other. Imagine how long it would take to build a railroad under the old system of working roads, and then we can get an idea how long it will take us to get good wagon roads if we adhere to that system.

All intelligent men know that the old system has proved a failure and that wherever the money system has been given a fair trial it has proved very satisfactory.—A. A. Arnold, Galesville, Wis.

I am in favor of having the road tax paid in money and the roads laid out under the supervision of competent engineers and road commissioners. Living, as I do, 23 miles from Milwaukee, and being engaged in truck farming, I know from personal experience and from that of my neighbors that we are in great need of better roads. The time is not far distant when a farmer at Janesville just after breakfast will mount his wagon, which is loaded with 100 bushels of potatoes, run to Milwaukee, sell his load, and arrive home in time for his supper. He will do this and more when the roads are in an improved condition and when he is in possession of the improved road wagons which are now being constructed. Let the good work go on.—L. C. Word, Caldwell, Wis.

I am not opposed to paying road taxes in money, but believe that no road law enacted will become efficient that does not prescribe the manner by which and the material of which the roads shall be built. The Good Roads League is accomplishing wonderful work in arousing the public mind to the absolute necessity of bettering the condition of our public roads.—Thomas H. Mosher, Kneeland, Wis.

We have not had any experience with the cash system in our town. But I believe that to be the right way to collect highway tax, and am glad to know that public sentiment is rapidly tending in that direction. I am convinced that more and better work can be done with \$1 paid in money than has usually been done with \$1.50 paid in labor. Not that it is impossible to do just as much by the labor system, but the fact is that it never has been done.

I know well enough that money can be squandered on roads as well as anywhere else. But there is this difference, that we are more likely to keep our eyes open when we pay money for a certain purpose, and demand to see the equivalent for what we have spent. Town officers, as a rule, are held to strict account for the manner in which they have disbursed the public funds. But who has ever been called to account for squandering the labor tax?

The State has committed to the citizens of the town two great systems, that of the common schools and that of the highways. On the proper maintenance of these depend the intelligence, wealth, and general welfare of the commonwealth. It is in the power of the citizens to make either, or both, good, bad, or indifferent.

I wonder it has never occurred to our labor-loving tax payers to demand the privilege of working out the school tax. Why not? Mr. A., who has a large tax, could teach the school for four weeks, Mr. B. could work out his in two weeks, and Mr. C. could teach out his in three days. D. and E. could haul fuel, and Mr. F. could prepare it. There would be some advantage in this system. If Mr. A. should be ill, or have business in town, he could send his boy or his hired man to teach in his place. Of course, the school would not make the progress that it does under the management of one competent teacher, but the tax would be paid, and the result, as a whole, would not be worse than that obtained under the present system of working out the road taxes for the bettering of the roads. The two cases are parallel in many respects.

The good roads discussion is bearing good fruit. There is, all abroad, a growing sentiment in favor of improved roads, and this sentiment will demand proper methods. In the meanwhile, let the agitation of the subject go on.—George C. Hill, Rosendale, Wis.

I think we have in the town of Rudolph the best roads in Wood County, because we want good roads. We are liberal in voting a special tax every year for said purpose, and the balance of the road tax is levied by the old custom. I prefer the system under the new law, and would like to see it enforced hereafter.—Ferdinand Phillips, Chairman Town of Rudolph, Wis.

The cash tax is the true way out of the woods on this road question. We never will have roads until this is universally practiced. It need not be a bugbear of a tax either. I would suggest that after the tax is levied and collected, such of the farmers as were willing to work for going wages, and will do as much work as they are paid for, should be hired in their own towns. But this matter should be left with the road commissioners. There is no doubt that twice as much would be done, and being under a good man, the work would be more intelligently done.—W. N. Johnson, Pathmaster, Oxford, Wis.

I believe there has been more good work done in this county in the last three years than in the six years preceding. When the new law went into effect in our town we voted to pay the tax in cash and have one overseer instead of nine, as before. We worked in this way two years, but found that one overseer with one crew could not keep all the bad places patched, and in a few cases work was neglected too long, costing more to repair than if taken in time. So last year we had four overseers looking after about 10 or 12 miles each, and find this works well, as the work is done early in the season, and on prairie soils we find that work done in May is better than in July. The overseers are allowed to hire farmers who will do good work, paying them with a town order, which will apply on their taxes. The overseers have had no trouble in getting good work done under the cash system. I think the new law just passed, allowing a vote to pay in labor, is a step backwards, for the overseer will not be able to do as good work, as there are many renters who are obliged by contracts to work the road tax on the farms they occupy who take no interest in the work, but will now be allowed to go on and put in time as of old. Almost every town in our county has one or more graders and they are doing work at one-third the cost of the old method. Keep up the good work and the roads will continue to grow better.—W. C. Bradley, Hudson, Wis.

No subject which has come before the legislature in the two terms I have served has been of so much importance as the one. How to get rid of the old mossback system of levying road taxes and the old 1849 districts. It has been a source of much left-handed delight to me to see how the average member will persist in thinking that the farmer still wants to work out the road taxes and drive to town in the mud. Kill the average politician, or convince him that he misrepresents the farmer when he claims they are not in favor of a better tax system and better roads, and the problem is solved.—Wm. O'Neil, Assemblyman, Washburn, Wis.

This town has worked on the cash basis since it was organized. There are so few settlers in our town that the old way of working out road taxes would not pay us. I am sure the cash basis is the best. We have a grader in our town, and it certainly saves 50 per cent of labor, if not more.—J. E. Anderson, Chairman Town of Crandon, Wis.

Our county has been working to obtain good roads since 1888. We are able to accomplish more by the cash system than by the old system of working out the taxes, although we have increased our town and county taxes some, due to the fact that annually we construct many new roads, besides trying to improve and maintain the old ones. The people here think favorably of the new system and recommend it for the future.—W. D. Cornagey, Chairman Town of Pelican-lake, Wis.

Our town has always collected its road tax in cash since its organization, and for the past three years has hired nearly all labor by the day and had the work done by an overseer of highways under general instructions from the town board. Prior to this time the work was let largely by contract to lowest bidder, but we find the day work more satisfactory in that we get better and more work for the money expended. Our town never had any road machinery except scrapers and plows till this season. Last spring we purchased a stump puller and a champion steel road grader, and I do not exaggerate when I say we can build turnpike roads with this grader for one-tenth the cost under the old system of plow and scraper. We have not reduced the amount of our road taxes. All our people like the cash system. Our town is ten years old, but never got any gravel onto our roads till this year. But this year with our road machine we have made narrow turnpike on eight or ten miles of road and covered about one and one-half miles with gravel. I say by all means have the cash system of road tax, and remember you can not build roads without money.—F. S. Campbell, Chairman Town of Gagen, Wis.

The board of supervisors and other county officers of the counties constituting the First Iowa Congressional District assembled in this city Tuesday for a two days' session. Upon motion of Mr. R. D. Du Bois, of Jefferson County, the following committee was appointed to draft a resolution to ask the legislators of the different counties of the district to present to the State legislature a bill for a change in the mode of collecting road taxes and the working of the public highways. The motion was adopted unanimously, and the following committee was appointed: R. D. Du Bois, J. F. Daugherty, Sol. Cavenee.

The committee reported as follows:

Gentlemen: Your committee, appointed to recommend a change in the collection of township road tax, would respectfully recommend the following:

That the board of township trustees of every township in each county shall, at their regular April session, determine the amount of taxes necessary for improvement of roads in their respective townships for the year following, which amount so fixed shall be certified to the board of supervisors, who shall levy the amount so certified, and order the same placed on the tax books of the county, and the county treasurer shall collect the same, as other taxes, without charging a commission therefor, and shall pay the same over to the township clerk upon order of the chairman of the board of trustees of the respective townships. The money thus collected shall be expended on the highways of the respective townships under the supervision of the township trustees. [This resolution passed unanimously.]—Burlington, Iowa, Hawkeye, November 19, 1896.

Resolved, That all road taxes should be paid in cash, as experience has shown that several times the usual amount of work has been accomplished where this plan has been in force in place of the old system of working out road taxes.—Farmers' National Congress, Indianapolis, November 12, 1896.

I, for one, would like to pay road taxes in cash, as I know we can get better roads that way. Our roads are very bad and no better than they were fifteen years ago. I hope the league for good roads can do something to get the farming classes to see the necessity of better roads.—A. M. Turgason, Town Chairman, Fivepoints, Wis.

Comparative Results of Labor and Money Systems.

The town of North Castle changed its system of working highways about 4 years ago from the labor tax to the money system, and thus far it has proved to be decidedly the best for us, as the money so raised has been judiciously expended.

The towns of New Castle and Bedford, adjoining us, have both adopted the money system, and, as far as I can learn, it is very satisfactory.—Chas. McDonald, Town Clerk, North Castle, N. Y.

In reference to the change from the labor tax to the money system, I would say that I prefer the latter, not only for the sake of economy, but also for the sake of having better roads; for I think where there are road commissioners elected who understand their business, and are given a certain sum of money to be used in repairing the roads, that the said roads will be put in better repair than they would be if they were repaired under the old system. Under the old system in some cases it is simply a question of putting in the allotted time without any view of improving the road.—J. Alfred Fordham, Town Clerk, Pelham, N. Y.

The town of North Salem changed its system of working roads in 1881. We have worked the roads by tax ever since, and we all like it very much. We have better roads, because they are worked up in the proper season. There are at present a number of towns in Westchester County working their roads by the tax system.—Town Clerk, North Salem, N. Y.

It is the opinion of the people in our town that money or tax system of working the roads is by far the best; that the roads have better attention, etc. I have looked into this matter somewhat, and am of the opinion that it is by far the best method.

The towns of Rye, White Plains, Mamaroneck, and New Rochelle all work their roads by the tax system.—Ebenezer Bull, Town Clerk, Harrison, N. Y.

We have made no recent change in our road system. Years ago we changed from the old way of citizens doing work on the roads.

By an act of the legislature in this State \$4,000 are raised each year for the repairing of our roads. The highway commissioners have charge and let contracts for the work done.—Jacob C. Moore, Town Clerk, New Utrecht, N. Y.

We are about entering upon the second year of working roads by tax levied upon taxpayers instead of the old system. Under the new system I think we can get better roads, properly managed; but the present State highway laws give the commissioners too much power, thereby running heavy bills that could in a measure be avoided. I believe the new method is an improvement upon the old way.

Several towns in this county are using the money system, viz: Union Vale, Washington, Beekman, and perhaps a majority of the towns are coming into line.—Eugene R. Schryver, Town Clerk, La Grange, N. Y.

This town has adopted the money system for road taxes in place of the labor tax, and find the benefits derived from the change to be greater than those received from the old method of pathmasters.

We receive more for the money raised in this way, because it is judiciously expended under the supervision of the commissioners of highways.—John C. Calpin, Town Clerk, Rye, N. Y.

I think it is a much-needed change to work the roads by tax instead of the old way. Not only do we have better roads, but I think it is a much cheaper way, as the tax is so low no one feels it.

The towns of Pleasant Valley and Washington work their roads by tax.—A. C. Smith, Town Clerk, Stanford, N. Y.

Permit me to say that the money system in relation to roads has always obtained in this town.

Besides three commissioners of highways, one of whom is annually elected to the office for a term of three years, we have in this town, at present, an improvement commission (five commissioners) created about five years ago by special legislation, and \$10,000 for highway purposes is annually collected by direct taxation and handled by the improvement commission.—George J. Dunnigan, Town Clerk, Westchester, N. Y.

The roads here have been worked on the money system for the past four years, and it is found to be by far the very best system. The roads show a decided improvement over the old system of day labor.

The town of Ossining, I think, works under the money system.—S. Allen Mead, Town Clerk, Cortlandt, N. Y.

We have adopted the money system of working roads and we have very much better roads than under the old system of working them. If we could only let out the contracts for more than one year, it would help out very much. Then the contractor would feel a great deal more interest in his road, knowing he could have the benefit of his labor and care for the next year. As it is now, they seem to do as little as they can and get their pay. I think, also, they ought to be compelled to work the roads as early in the spring as they can, and not put off the road work until they get all their farm work done.—W. B. Adams, Town Clerk, Bedford, N. Y.

The roads are much better in every way under the money system and give satisfaction.

The town of Sandford, Dutchess County, works its roads by this method also.—Charles Kelley, Town Clerk, Washington, N. Y.

The system of working roads by tax was adopted about twenty years ago. It is impossible for me to give you any other information.—Humer E. Eldwher, Town Clerk, New Rochelle, N. Y.

This town has adopted the money system for road taxes in place of labor tax, and I can say that I do not think there is anyone in the town who would vote the roads worked the old way. We have much better roads worked on the money system.

The town of North East has adopted the money system, I believe.—H. J. Eggleston, Town Clerk, Amenia, N. Y.

In this town, outside of the village of Port Richmond, they bond the town for the roads, and also collect road taxes.

Personally I think this course is not right, but it has always been the custom and they can not change this year, but doubtless will next year.—H. J. Sharrett, Town Clerk, Northfield, N. Y.

In answer to your inquiry in reference to working the highways in this town by money or contract system, will say that if properly managed, it is much better than the old way by labor tax, so far as it has been tried in this town.—Phillip Pearsall, Town Clerk, Huntington, N. Y.

Our town voted at the annual town meeting in 1889 to change from the labor system to the money system of working roads.

From what I can learn, it is generally conceded to be a great improvement over the old way, though of course there are some who oppose it, and a vote was taken in 1893 to ascertain if the town should return to the old way, which resulted in a good majority in favor of the money system.—John S. Eells, Town Clerk, Walton, N. Y.

I take great pleasure in informing you that this town adopted the money system of working the roads several years ago. Even those who were at first opposed to it now admit the system is an unqualified success. Some, however, think that the work should be let out by contract instead of being done under the supervision of the highway commissioners.

The town of Cortlandt, I believe, has tried the same system with the same gratifying result.—Robert T. Dennis, Town Clerk, Ossining, N. Y.

Our town has the money system for road taxes, and the system is more perfect than the labor-tax system. It gives the commissioners more power. They can do more work, on the whole, and I can say it is a great benefit.

The towns of Greensbury and Ossining work under the money system.—Millard M. Dewitt, Town Clerk, Mount Pleasant, N. Y.

This town has been working its roads with the money system for three years and we find we have very much better roads, take it all over the town; for before there were some hill roads that did not receive attention, for there were so few people living on them that they could not work them as they ought to be. Now the commissioners go over the roads and lay out the work where it is needed the most.—E. L. King, Town Clerk, Snynra, N. Y.

We adopted the money system about seven years ago. I think it has resulted in improving the roads to a certain extent, but the farmers seem to be greatly opposed to it, except such as live in the high hills or on sections where there were but few under the labor system to work long stretches of road.

It has cost more by considerable to repair the highways under the money system, I think.

With the law properly framed and enforced, I think the money system would be desirable.—Ashley B. Harnes, Town Clerk, Canaan, N. Y.

The roads in this town are kept in order from income money paid by the town. I think it is much better than the labor tax.—John L. Vonheis, Town Clerk, Gravesend, N. Y.

The town of Greenburg has been working its roads by the money received by tax for that purpose for a number of years past. I believe that all the towns composing the county of Westchester are working under the same system. In fact, I do not think it possible to do the work in any other manner. Under the old system of labor tax it was the habit of those called upon to work the roads to furnish the poorest kind of labor and material. Under the present system we have the best that can be procured.

As to the present condition of our roads, I might say that they are not at all satisfactory, but are in much better condition than possible under the old system.—K. H. Purdy, Town Clerk, Greenburg, N. Y.

When I first came to reside at Canarsie, in the town of Flatlands, in 1865, we had the labor system for roads. Sometime later that was changed to the direct-tax system. The change is for the worse, I think. There is not a town in Kings County or on Long Island which has as bad roads as we have here.

I do not know of any other town having made the change.—James Savage, Town Clerk, Flatlands, N. Y.

Comments on the Contract System of Maintaining Country Roads.

A large number of letters was sent out from this office in January making "inquiries regarding the comparative merits of the various systems of repairing and maintaining the country roads, especially as to whether the contract system has been successful in places where it has been tested." The replies received show a variety of opinions, the writers agreeing but in one thing, namely, that the old method of "working" the roads under supervisors is entirely unsatisfactory. What shall take the place of this old method is still a matter of doubt in some places and of experiment in others.

Extracts from several of the replies, written by men who have had experience in road matters, are given herewith with the view to stimulate discussion as to methods and means of repairing country roads, and with the hope that out of the discussion may result a feasible plan for correcting the evils that now so generally prevail with the system of working the roads under the direction of supervisors.

OPINIONS OF CORRESPONDENTS.

We have in this parish now a contract system of roads. At the beginning of last year we gave out a contract after advertising for bids, by which we pay \$50 per mile for making and maintaining roads for the first year, \$40 for the second year, and \$30 for the third year. The contractor has continually working on the roads two sets of the latest improved road machines. The road is made perfectly round, and the water disappears immediately after each rain. The drummers pronounce our roads the finest in south Louisiana.—Dr. W. Lawrence Stevenson, New Orleans, La.

The care of country roads in Des Moines County, and perhaps in all other counties of Iowa, is still in the hands of district road supervisors, under whose direction the road tax is worked out at such times when it will not interfere with farm work, and, consequently, our roads are hardly ever in good condition.—Wm. Steyh, City Engineer, Burlington, Iowa.

The general law of the State is, in brief, the township supervisor system, with the right to each taxpayer to work out his road tax. A cash tax also is collected, most of which goes to payment of supervisors, purchase of implements, tools, material for bridges, etc., and in certain cases a portion of it is used in building or rebuilding bridges and opening new roads. These latter are usually let by contract, but all the work done on roads once opened is done by labor of taxpayers under direction of the supervisors. I know of no place in northeastern Pennsylvania where the contract system is practiced, but I understand that in some districts of Chester County that system has been in operation for many years.—N. F. Underwood, Lake Como, Pa.

My own experience is that one-half of the labor tax as now assessed, if paid in money and applied on contracts when most needed, would do much more permanent and efficient work in road improvement.—B. A. Joy, Commissioner of Highways, Springport, Mich.

Contract system has never been employed here. Road work is all done by district supervisors, and fully one-half of the fund is wasted through incompetent men.—G. L. Tremain, Humboldt, Iowa.

In Massachusetts the town is the unit, as is the case in the other New England States, and, although the county commissioners have delegated to them certain powers and control of laying out county ways, the towns through which they pass are charged with the duty of construction and maintenance of the same, and only in default of the action of the town do the county commissioners assume control of construction and repairs. Repairs in this State of county ways are not made as a general thing by contract, but are carried on under direction of the towns, and the manner and character of the said repairs might vary somewhat in the different towns, but it is safe to say that said repairs would be on a par with the character of the town ways through the roads which are called upon to make the repairs.—R. G. F. Candage, Brookline, Mass.

We in this section of New Jersey have the roads repaired by day labor. We believe it is better for us than the contract system.—Clayton Conrow, Cinnaminson, N. J.

The old, extravagant method is in vogue in this county, namely, paying the road tax in labor. Effort was once made in the township to require the payment in money and adopt the cash system, but the small majority in some 250 votes favored the old method. It is greatly to be regretted that the cash and contract system has not been extensively adopted in this county and State.—J. N. Muncey, Jesup, Iowa.

The contract system of road building is very little used in Iowa, but in one or two cases where it has been used it has given satisfaction. We need more of the contract system, as our roads here are just excuses, and so long as they are worked in the way now followed, they always will be.—E. Kostomlatsky, Oskaloosa, Iowa.

In some of our near-by hill towns the contract system was formerly sometimes adopted and seemed generally to give satisfaction, as it was for the interest of the contracting party to keep the roads from getting out of repair.—Ethan Brooks, West Springfield, Mass.

Our roads are constructed and maintained by a road poll tax, which is very unsatisfactory and insufficient.—J. L. Minton, Napier, Mo.

The contract system has been adopted only to a limited extent in Missouri. There is a growing sentiment in favor of the contract system in this State. At the recent Good Roads Convention held in Columbia, Mo., January 16-18, a resolution was adopted to the effect that the convention favor the contract system for constructing roads.—Hon. Levi Chubbuck, Kidder, Mo.

The system, or method, of working roads in Iowa is probably the worst that could be devised, as the State law permits the road tax to be paid in work. About ten years ago the county supervisors were authorized to levy a tax of one mill on the dollar (less than one-fourth of the road tax), and where this tax has been levied it has been expended under the contract system. In this county (Linn) it has been expended in making permanent improvements, such as cutting down hills, filling up low places, draining and macadamizing, and it is the general opinion that the roads derive more material benefit from the tax expended by the county than from the work done under the road district system. Good roads we never will have so long as the road tax is so largely payable in work.—James Yuill, Cedar Rapids, Iowa.

My opinion would lead me to adopt the contract system, it being far superior to the working road tax system that we now have.—William W. Hooper, Leavenworth, Kans.

Of all ways, the most expensive is the labor system, and probably the least expensive is the contract system.—John L. Mandeville, Brookton, Tompkins County, N. Y.

We have tried in this State the contract and free labor and the commutation tax systems upon our country roads. * * * In Spartanburg County the supervisor has bought a road machine and done some work which has been satisfactory. In York County several miles of first-class stone roads have been built, but the greater portion of the roads are such as you would find in any hill country—clay, half gravel, and rock—and all worked by the road hands. In Aiken County the road hands were relieved from road duty and a commutation tax of \$1 was substituted, with instructions to the supervisor to work the county convicts and to lease out the roads, but the county was so badly in debt, and this and other things prevented this, and it failed. In Barnwell County we passed a special road law, which is based somewhat upon the Mecklenburg County law, and have attempted to ditch our roads and have them thoroughly worked. We pay our overseers \$1 per day and have a fully equipped chain gang, together with a first-class supervisor. The convicts have been confined to the repairing and building of the heavy causeways and bridges and to the cutting down of the heavy grades. I am now preparing a bill to be introduced at the legislature, which is now [January, 1896] in session, which enables the various counties to get more convicts from the State penitentiary and to have a fund to erect some good roads, the leading feature being the improvement of the dirt roads.—S. G. Mayfield, Denmark, S. C.

The general law of road working operative in this country is that the county is divided up into road districts; in each road district there are three road commissioners. These commissioners subdivide the roads in the districts into sections, and place an overseer in charge of each section, with such number of hands as the commissioner considers necessary for this work, in that way dividing out all of the road hands of the districts. The hands are subject to as much as fifteen days' work during the year and are summoned by the overseer when required to work. This method answers very well in sparsely populated portions of the county and where the travel is light upon the roads, though even in such portions the roads in winter are in poor condition, as our country is a clay one and wet weather makes the roads very soft. Near the towns and along the main thoroughfares this method has been utterly inadequate, both for the want of necessary tools and of concerted, intelligent action over the whole line.

The general system being found so inadequate, in November, 1881, a county working gang was organized from the misdemeanor convicts of this and some adjoining counties. Mules, wagons, scrapers, an engine, and a rock crusher were bought, and the gang, which has varied from 40 to 60 hands, kept constantly at work since that time. The consequence is, that all of the main thoroughfares leading from Rome, which is the county seat, have been macadamized for a distance of 5 to 12 miles out. In addition to this, it has assisted in macadamizing some of the streets of Rome, has built and repaired culverts and bridge piers and approaches to bridges over streams on the county roads, and has made passable at all times the roads over which it has worked. The most of these roads prior to the working were almost impassable for a loaded wagon during the winter weather. These convicts have portable quarters, which they occupy during the spring, summer, and fall months upon the roads away from Rome. During the winter they have permanent quarters in houses, in which stoves are placed for heating at night and during weather which is unfit for them to work in. It is during the winter that they work upon and near the streets of Rome. The superintendent in charge of the convict gang estimates that he can grade and macadamize a road 16 feet in width, covered with broken stone, 9 inches deep in the middle and 6 inches deep on the sides, at an average cost of \$1,000 per mile.—Halsted Smith, Rome, Ga.

Our town has been building and repairing its roads for the last two years under the law of 1893 with satisfactory results. Our road taxes have been paid in money and we have had one commissioner to look after the whole town. It is my honest opinion that we have improved the roads more in that length of time than has been done in the twenty years before.—H. O. Gray, Oregon, Wis.

In this State, so far as my observation goes, the system of repairing and maintaining country roads by requiring citizens to work a certain number of days, is wholly ineffective. In some counties of this State I believe contracts are let by competition for keeping up certain sections or amounts of country roads. This works well where the contracts are properly enforced, and there is no reason why they should not work well if the specifications upon which the bids are based are properly drawn and enforced. Within the last few years the roads approaching this place (Morgantown) have been very materially improved by the use of road machines and contract work. In fact, it is the only way that we have been able to secure anything like satisfactory roads.—John A. Myers, Morgantown, W. Va.

While our present State law leaves it to each town to determine for itself at the town meeting whether road taxes shall be paid in cash or "worked out," only a few towns, perhaps, have adopted the cash system. I think this is due to want of enlightenment on the subject, and the present efforts of our league are directed to this end. The subject is being widely agitated, and we are confident of sufficient success so as to amend our road laws in the next legislature in January, 1897, so that all road taxes will be paid in cash without any "ifs" and "ands." The farmer's institutes, of which there are about one hundred and ten this winter, are, all of them, making the good roads question a prominent feature, and their arguments are squarely in favor of the cash system. The press is also doing a great deal to help us upon the same lines.—Otto Dorner, Milwaukee, Wis.

Our township roads are kept in repair by two overseers of roads selected by the township committee, the moneys appropriated for road repairs being expended under control of the committee and under the supervision of the overseers, who report to the committee. We have in this way kept our stone roads in excellent condition at a less cost per mile than for the old dirt roads. The methods employed on the new State-aid roads in this county are still rather crude and very expensive. It is probable these roads in the near future will be placed in the hands of the township committees of the townships in which the roads are located, the repairs to be made and bills rendered to the county for actual expenses incurred during the three preceding months.—J. S. Rogers, Stanwick, N. J.

In Adams County, this State, where I resided for several years, the contract system of road making and repairing has proved much better than the old system.—John M. Stahl, Chicago, Ill.

So far as the contract system is concerned in this State, I believe a general consensus of opinion is that no other should be used if a good road is desired.—W. D. Hoard, Fort Atkinson, Wis.

I have no accurate knowledge of the exact dollars and cents expended in road improvements in the vicinity of my residence in Delaware County, but I do know that some three years ago, before the borough of Swarthmore was incorporated, it was then in Ridley Township, which had previously voted to expend some \$80,000 in good roads. I was given to understand from members of the committee on road improvements that about one-third more roadways were completed, under the contract system, for the same amount of money than under the township supervisors of roads.—George D. Gideon, Philadelphia, Pa.

The plan followed in this State for maintaining country roads is that of working out the poll tax under the supervision of the road overseer. This plan is a failure in Kentucky, as it is everywhere else, and entails great loss of time, labor, and money without appreciable improvement of the roads. The macadamized roads of the State are almost entirely in the hands of corporations, and are thus removed from public control, except indirectly.—Owen Lawson, Louisville, Ky.

ROY STONE,

Director, Office of Road Inquiry.

Approved:

JAMES WILSON,

Secretary.

WASHINGTON, December 15, 1897.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., December 16, 1896.

SIR: The experiment recently made by the citizens of Monmouth, Ill., in the construction of brick-paved country roads is attracting so much attention throughout the country, and may have such important results in the prairie regions, that I respectfully recommend the publication of the accompanying information upon the subject as Circular No. 25 of this office.

Very respectfully,

Hon. J. STERLING MORTON,
Secretary of Agriculture.

ROY STONE,
Director Road Inquiry.

BRICK PAVING FOR COUNTRY ROADS.

The successful use of vitrified brick for the paving of streets has caused much discussion of its adaptability to country roads in sections where good stone for macadam is not readily obtainable.



FIG. 1.—The New Brick Road, Monmouth, Ill.

The people of Monmouth Township, Warren County, Ill., have the credit of being the first in this country to pave a country road with bricks (fig. 1). This experiment will be watched with much interest by all who are concerned in road improvement in the prairie regions.

These vitrified bricks are not made of clay, but of a peculiar shale rock, and are so exceedingly hard that a sharp-edged fragment will cut iron or steel.

For the following account of the origin and execution of this project we are indebted to the Monmouth Daily Review:

The brick road came by way of evolution. When hard roads building began in this township four years ago it was decided to expend the money available in an experimental way, and that was done. The combination dirt and stone roads were built first, nearly 5 miles now being completed, and then came the experimental stretch of brick paving. All of the roads are now in such condition as to give general satisfaction all the year, and are reached with great delight in the muddy season.

Commissioners Burford, Sample, and Miller are to be highly commended for their labors for the public good. They candidly stated at the outset that the work would be experimental, and that mistakes might be expected, but they hoped to pave the way for the better success of those who came after them. They have done so, and if all the favorable comment concerning the roads means anything, it certainly means that the people whom they represent are more than pleased with the results.

The first definite steps toward the construction of these hard roads were taken early in 1892. For years all kinds of travel in and around Monmouth had been



FIG. 2.—The New Brick Road, looking west from near Sunny Lane.

impeded at times by the mud, and that winter the blockade had been complete. For several days about the first of March there was a complete blockade all over the county, two horses being required to pull even a light buggy along the roads. In Monmouth the 'bus and dray lines quit business altogether, and wheelbarrows were called into requisition to transfer baggage, mail, and freight to and from the depots.

AUTHORITY FOR CONSTRUCTION.

The Daily Review had been frequently urging the need of better roads and arguing that they would pay for themselves in such troublous times. On March 13, 1892, Highway Commissioner James Sample suggested to the editor the possibility of hard roads being constructed in the township under the provisions of a road law enacted by the State legislature in 1883. The first sections of this act are as follows:

AN ACT to authorize the construction of gravel, rock, macadam, or other hard roads. Approved June 18, 1883. In force July 1, 1883.

SECTION 1. That on the petition of fifty land owners, who are legal voters, of any township to the town clerk thereof, in counties under township organization, or road districts in counties not under township organization, to the county clerk, he

shall, when giving notice of the time and place for holding the next annual town meeting or road district meeting, also give notice that a vote will be taken at said election for or against levying a tax not to exceed one dollar on each one hundred dollars assessed valuation of all the taxable property, including railroads, in the township or road district, for the purpose of constructing and maintaining gravel, rock, macadam, or other hard roads. Said petition shall state the location and route of the proposed road or roads, not exceeding two; and shall also state the rate per cent, not exceeding one dollar on each one hundred dollars, and the number of years, not exceeding five, for which said tax shall be levied.

SEC. 3. If a majority of all the ballots cast at said election shall be in favor of said special tax, then it shall be the duty of the commissioners of highways of the township, or road district, to levy a tax in accordance with said vote, and certify the same to the town clerk in townships under township organization, or to the district clerk in counties not under township organization, as the case may be, who shall certify the amount voted to the county clerk, who shall cause the same to be extended on the tax books for the current year: *Provided*, That the length of time for which the special tax levy shall continue shall not exceed five years, and also the road or roads to be improved must be designated in the petition. The commissioners may also receive donations in money, labor, materials, or other valuable things, to aid in the construction of said road.

Additional sections provide for the manner of collecting the tax, employment of engineers, plans and specifications, receiving of bids, etc.

The proposition met with immediate favor. Farmers and residents of the city called to put their names on the petition, and with scarcely any solicitation except through the columns of the paper nearly twice the necessary number of names was

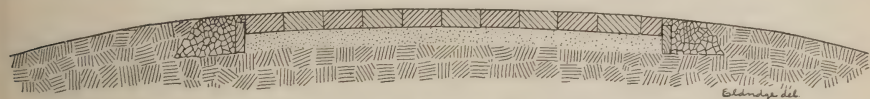


FIG. 3.—Cross-section of brick road, Monmouth, Ill.

secured. The petition was filed with Clerk Jones March 19 and on March 22 he gave notice of the election.

The election was held April 5, and the proposition carried, only 229 votes being cast against it.

DETAILS OF THE BRICK ROAD.

After various experiments with stone construction, the commissioners decided to build a section of brick road, as shown by fig. 3.

This road was built by Brodine & Dungan, contractors, and their bid was \$2,650 for 3,000 feet, or about 90 cents a running foot. The ground was prepared for it by grading and being allowed to stand for two months. It was treated to an occasional scraping so that it would pack evenly, and when the contractors were ready to lay brick it was as hard and even as a floor.

The first thing was setting the curbing. This was made of 2 by 6 inch oak plank, set 7 feet apart, and held by oak stakes 18 inches long, and put down every 4 feet. Inside this was put a 5-inch bed of sand. This was evened up and the single course of No. 1 paving brick, made by the Galesburg Paving Brick Company, was put down. They were set on edge, and make a fine roadbed. Outside the curb 2 feet of the crushed rock was laid, graded up to make an easy approach. This makes a road 11 feet wide, and the finest in the land. The earth road on each side was graded and worked; making it all 40 feet wide and affording tracks on each side for use in dry weather.

DRAINAGE.

The stone road is drained part way with lines of 5-inch pipe put down to a depth of about 3 feet on each side. The remainder of the way a line on one side is depended on. The north road from Hewitt's to the track has a 6-inch tile down the center.

The next 80 rods has two strings of 5-inch tile put down 10 feet on each side of the center. This is through a stretch of flat land.

The rest of the way the land is rolling and the surface drainage is sufficient. This is the state on the brick road also, where the water will take care of itself.

THE WIDTH OF THE ROADS.

About the only objection that has been urged against the roads is that they are not wide enough. This may be an objection, but it is not a serious one. Each of these roads is able to take care of its travel except in exceptional instances. None of them is hard to get upon and a driver can turn off and on without difficulty.

COST OF STONE ROADS.

The stone roads of Monmouth have cost on an average 70 cents per foot in length for a single track 8 or 9 feet wide.

The following extracts give the opinions of local experts upon the two systems of road:

EDITORS REVIEW:

DEAR SIR: In answer to your request for my opinion of our combination pavement for public highways, beg leave to say a few words on hard roads in general and this brick and stone road in particular.

It is an unquestionable fact that good and enduring roads can be built of crushed stone. The great thoroughfares built in Caesar's time are good roads to-day. Given unlimited capital and an unlimited amount of first-class road material, roads just as good and enduring can be built to-day. But we have neither this capital nor first-class stone. Nothing but ordinary limestone is available; neither trap, granite, nor gravel is at hand. A design suited to our circumstances must be submitted or else we must be still longer at the mercy of wind and weather to keep in touch with the busy hum of trade. Hence our roads are built long rather than wide, so as to get the greatest possible good from the expenditure. And it is certainly true that such of these as have been built are giving as good service as could be expected. It is an axiom of good engineering that both telford and macadam roads will need constant repair, and this most especially during the first two or three years after laying. Our stone roads have needed repairs and have been repaired. So also have the many miles of dirt roads throughout the county needed repairs, and doubtless those most traveled have been treated to their annual grading up. But in the one case the result is a public highway fit for public use every day in the year; in the other, that same old relic, as uncertain as the weather—to-day a road, to-morrow a morass.

The fact of having been compelled to build our roads of single-track width has certainly made greater the expense of keeping them in repair, owing to the soft material and the constant wear of wheels in the same place. This evident defect led to the idea of using paving brick, single course, and set on sand. On account of economy, cut and dressed curbstone was discarded, and 2 by 6 white-oak plank, reenforced by about 2 feet in width of crushed stone, was used instead. These were set 7 feet apart on the natural surface, about 5 inches of sand placed between, and on this No. 1 paving brick set in the usual manner. Earth was then graded up to the crushed stone and the whole road thoroughly rolled.

It is only just to say for those interested in designing this road, that there were no models to be visited nor standard specifications to be copied. It could hardly be expected in all the minutiae of construction that no change could have been made that would have decreased cost or increased efficiency. But of this it is certainly too soon to form a definite opinion. A year of actual use is the best demonstration of

the merits or demerits of such a highway. However, it is my belief that this principle of construction is superior to either telford or macadam for a single-track roadway. While the first cost is a little greater, that of maintenance will more than make compensation in a few years. Besides, the brick track is certainly superior to the stone, whether driving for pleasure or hauling for profit.

Time alone will tell just how this road will wear. It may settle in places; heavy loads following in the same track may depress it somewhat; it may be necessary to grade more dirt alongside; perhaps some day to put on more crushed stone; but I venture the prediction that wherever and whenever one of those paving brick is found it will be still as hard and tough as ever, and ever as ready to stand between the wheels of traffic and the mud of Illinois.

J. ED. MILLER,
Engineer and County Surveyor.

GERLAW, ILL., November 19.

In answer to your inquiry, I would say that for at least three months in the year the rock road north of town is an absolute necessity, but during the remainder of the year it is but little used. When worn smooth it makes a fine road. A wider track would be better, but this does very well, as loaded teams are usually going toward town and those meeting them can easily turn out and pass.

J. N. CARSON.

I have examined the brick road west of town and think it far superior to the stone road. I believe it will last as long as three stone roads made of such stone as we have been using, and that it is much cheaper in the end.

Yours, etc.,

W. H. FRANTZ.

The Engineering News, of New York, in its issue of December 10, 1896, expresses a warm approval of this new departure in road construction, and asks:

Would not the laying of a strip of brick paving in the center of almost any macadam road be an improvement worth at least careful consideration?

The much easier traction upon the brick would not only be in itself a benefit to those using the road, but would cause the traffic to follow it almost entirely, especially the loaded wagons, which effect the most wear and do the most injury to a macadam road.

It appears to us that this combination of brick and macadam is the most promising plan for the improvement of suburban streets and country roads of heavy traffic that has appeared in a long time, and deserves consideration by every engineer who has to do with macadam roads. There are thousands of miles of city streets where the abutting owners can ill afford the assessments for the cheapest of block or asphalt pavements, and on the other hand the traffic is such that the maintenance of present macadam streets is a heavy burden. Can not the needs of such cases be met by placing a brick roadway in the middle of the street and covering all the rest of the width between curbs with broken stone?

The News also makes an additional suggestion in the direction of economy which may well lead to further experiment in this method of construction. It says:

But in localities where there is a long freight haul on paving brick the expense of even a 7-foot strip of brick in a road might be prohibitory. In such localities the scheme is worth considering, it appears to us, of laying two parallel narrow strips of paving brick through the middle of a macadam road, as illustrated in the accompanying cross section (fig. 4). These strips might be 16 to 20 inches in width and of such gauge that vehicles of all classes could follow them as they would a line of rails. The decreased traction on such a surface would be practically as great as if steel

rails were laid in the macadam, as has been proposed, and if properly laid they would wear a very long time under any traffic where a macadam road is justifiable at all.

There are thousands of places where a short piece of roadway is subjected to a very heavy traffic. Such roads occur around factories, mills, mines, quarries, railway stations, and many other places. In many of these places an ordinary dirt road is in use, and teams are hauling over it loads not one-fourth as large as they could haul over a hard surface. In many other cases stone roads have been laid and are effecting a great saving over the old dirt roads in cost of haulage, but are expensive to keep in repair under the heavy loads that pass over them. For such places as this the plan of using paving brick to take the heavy wear appears to be especially advantageous, and deserving of extended adoption.

The details of construction, such as the foundation under the bricks, the construction of the macadam at their sides and between them, the filling between the bricks, etc., would vary with local circumstances and with the teachings of experience; but they need not be considered in a study of the merits of the scheme generally.

It may be pointed out also in this connection that such a strip of brick pavement as is here proposed would make an admirable road for cycling, and the influence of that important body of agitators for road improvement might well be exerted in favor of this proposition.

SOME DIFFICULTIES OVERCOME.

The drawbacks to the narrow-strip method of construction shown in fig. 4 are (1) the danger of the tilting of the outside bricks in driving on and off, or crossing the line with heavy loads; (2) the danger of disruption or displacement by frost.

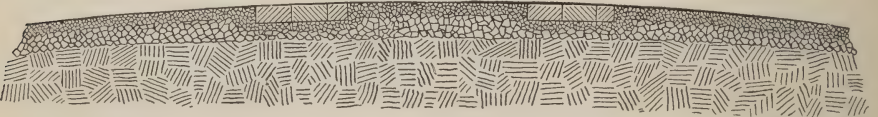


FIG. 4.—Cross-section of proposed 16-foot macadam roadway, with paving brick trackway.

To meet the first of these difficulties, a curbing of rough stone might be laid, as shown in fig. 5. If stone is not available, bricks could be set on end for a curbing, or a special form of brick might be designed for the purpose, of which the surface would form part of the track way.

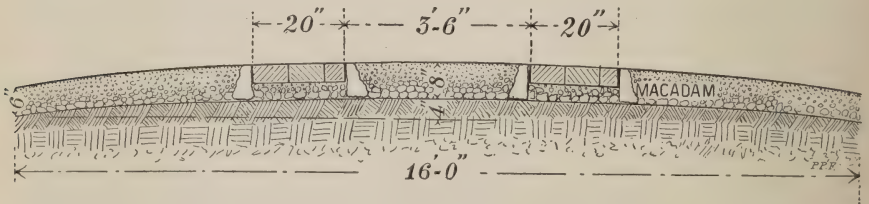


FIG. 5.—Cross-section of macadam roadway, with brick trackways stone curbed.

In cases where damage by frost is to be apprehended on account of the character of the soil, the construction might be combined with that of the Illinois farm roads used by Judge Caton, as described in the

Yearbook of this Department for 1894, page 503. The combination would be as shown in fig. 6.

The ditch above the drain tile could be filled with any coarse materials—field stone or quarry spalls too soft, or gravel too large for roads, or with the burnt clay in lumps which is used for ballast on some of

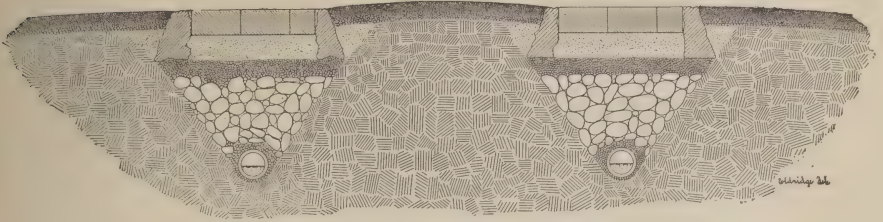


FIG. 6.—Cross-section of brick trackways, under-drained and stone curbed.

the prairie railroads. This filling to be rammed or rolled down and covered with a little gravel and enough sand for bedding the bricks. A light coating of gravel would serve for the space between the tracks and outside of them.

A road so built and protected should last for many years with no repair except to replace the gravel worn out by the horses' feet.

United States Department of Agriculture, OFFICE OF ROAD INQUIRY.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., January 16, 1897.

The accompanying address by Judge Thayer, of Iowa, who has given faithful and efficient service to the movement for better roads through many years, contains much matter of interest to the public generally. Its recommendations regarding action by the General Government can not, of course, be indorsed or commended by the Department, but to omit them would impair the unity and value of the address. I would therefore recommend that the address be published entire as Circular No. 26, of this Office.

Respectfully,

Approved:

J. STERLING MORTON,
Secretary.

ROY STONE,
Director of Road Inquiry.

GOING IN DEBT FOR GOOD ROADS.

[Address delivered by Judge Thayer, of Clinton, before the Iowa Bankers' Association at their annual meeting in Council Bluffs May 24, 1893.]

It is an inside figure to put the amount this country annually contributes to the mud fiend at \$250,000,000, of which amount Iowa pays at least \$8,000,000. A total loss. Mud does not give back anything to anybody. There is nothing reciprocal about it. It is a loss complete, absolute, and irrecoverable even in part. A man loses a thousand dollars by his house being destroyed by fire, but somebody is benefited by that loss. In rebuilding, the sawmill, the sash and door manufacturer, the carpenter, the painter, and the plumber find a market for material and labor. If a bank discounts a note which proves worthless, the money, while a loss to the bank, goes about on its mission and is not a loss without somebody's gain. Mud knows neither friend nor foe. In the natural organization of matter mud may have a place, but that place is not in the road.

The whole country is aroused as never before over the subject of better roads. The necessity for such improvements is everywhere admitted. No one says nay. Public sentiment having become settled on this point the agitation of the question may now be directed to some feasible plan for obtaining money to make good roads. The road tax has been doing its work ever since civilization taught mankind how to use the shovel and the hoe. But the road tax has not made much headway in making permanent roads. It has made more mud, but few better roads. It is idle now to even seek to place the blame anywhere. It matters not who is at fault. The road tax is all right, and it is the equitable method of raising money for road purposes. A different plan of finance is what is wanted. Not more taxes. Not more money.

Put \$8,000,000 a year into improving the thoroughfares of Iowa, and in ten years there would not be a mile of legally laid out highway in the State but would be converted into a permanent stone road. But as it is idle to talk about taking the amount Iowa annually contributes to mud to build durable roads, some other means of raising and spending money must be resorted to than are now common in any State in the West. But continue to spend the road money as it is now spent and in a thousand years the mud fiend will be patronized the same as to-day. His hunger then will be no less appeased than it is now. You simply can not make durable stone roads on an extensive scale with the annual expenditure of a 7-or 8-mill tax. You must find some other method or else give up in despair and go wallowing through the mud to the end.

My plan would be to borrow money on a long-time bond at a low rate of interest and use the taxes to pay the interest and principal. To do this a great many people will have to conquer their prejudices and listen to a kind of reason and argument that they turn from now with a solemn shake of the head and the exclamation, "No bonds if you please, and no debt for road building."

No debt! I admit there are mistakes made every day by cautious, prudent, experienced business men going in debt. But for that reason shall there be no more running in debt? The business of civilization is transacted on the credit system. The business of barbarism is transacted on the "no trust" plan. The 500,000,000 people who go in debt have food to eat, clothes to wear, and at night a place to lay their heads. The 500,000,000 who do not possess sufficient confidence in themselves to trust one another, never tasted flour or beef, go naked, and sleep out doors. Activity, prosperity, and thrift are the fruits of mutual dependence on one another, cemented with the legend, "I promise to pay." Stagnation, savagism, ignorance are the fruits of transacting business on the theory that nobody is entitled to the confidence of anybody.

Debt has made America what it is. Its flourishing cities, its vast system of railroads, its multiplicity of industries, which give employment to millions of intelligent artisans, its Columbian Exposition, its wonderful agricultural wealth and prosperity, could only have been brought about by one man using another man's money and paying something for the use of it. I can not imagine a more dismal condition of things on this mundane sphere than the world out of debt. When Columbus discovered America he found this great continent occupied by a race of beings who were not only out of debt, but who paid no taxes. A people as useless and

“ As idle as a painted ship
Upon a painted ocean.”

One-half the farms in Iowa are owned by persons who went in debt to obtain them, and even though a large share of the indebtedness now stands on the property, yet there is not one case in ten where the investment is a bad one, or where, under similar circumstances, the farmer would not do the same thing over again. Himself a grand example of the prosperity which debt creates, he should be the last man to shake his head and say nay, when the debt plan of building better roads is suggested. Financially, he has nothing at stake by reason of the adoption of that plan, and for his comfort, welfare, and happiness, he has very, very much to gain.

A man owns a city lot. His income above family expenses is \$500 a year. He proposes to erect a store on the lot, so that instead of its being an expense to him it will bring him in an income. He is prejudiced against going in debt. So he builds just as rapidly as his \$500 a year will permit, and in ten years he has a \$5,000 building to rent, which he leases for \$1,000 per year. Now, had he not been so prejudiced against going in debt, he could have borrowed \$5,000 at 7 per cent, put up his building in three months, and in ten years he would have made a net gain of \$6,000, and out of debt. His contribution to prejudice against going in debt is \$6,000. Might as well have been contributed to the mud fiend.

This illustration, applied to building roads, shows the difference in results between going in debt for money to build roads and building them with the income derived from road taxes—only the man who put up the building had something to show at the end of ten years for the money invested, while the people who pay road taxes have little or nothing at the end of ten years or at the end of any other period, to show for their money.

I do not advocate the issuing of bonds by the State, the proceeds to be used for building roads. I do not favor any plan which would permit the General Government to build roads in a State. I am in

favor of allowing the people of a township the right to vote upon the question of borrowing money, not to exceed a certain per cent per year, to use in road building. I would have road improvement a township matter, based on local option. If the people of one township want to build a certain number of miles of good road, I would not permit the people of another township or the State legislature to prevent it. If a majority of the people of a township want good, permanent roads, at a cost within certain prescribed limits, I would not put it in the power of the minority to prevent it. I would build good roads with the taxes now paid. I would cover the State with a network of durable, permanent roads, which can be used every day in the week on which to haul a full load, and I would do this without increasing the present road taxation one mill. With no greater levy than is now made, I would in ten years save by the use of good roads six or seven millions of dollars per year to the people of Iowa, and in twenty, twelve or fifteen millions of dollars per year. Let it be understood that in the next twenty-five years \$1,000,000,000 would be added to the indebtedness of this country, the amount to be used in building permanent stone roads, and the nation would enter upon an era of prosperity such as no part of the world ever before experienced.

It might be a good plan for the State to contribute an hundred dollars or more to each mile of permanent road built. The State could by this contribution prescribe the kind of road that should be built to secure the State's assistance, and thus obtain an uniform system of road building throughout the State.

But the people must have cheap money, and it must be borrowed, so that the road taxes will pay the interest, and in due course of time the principal. My suggestion is that the Government establish a financial bureau for loaning money to townships and such other subdivisions as the States may recognize, to be used in building permanent roads. The Hon. William H. Rhawn, of Philadelphia, one of the leading bankers of the United States, and president of the American Bankers' Association, thinks a bond drawing $2\frac{1}{2}$ per cent interest could be disposed of by the Government at par. In seventy-two years, with the interest invested at $2\frac{1}{2}$ per cent, such a bond could be paid, principal and interest, and the total outlay would not be more than 3 per cent per annum. To illustrate: A township whose assessed valuation is \$300,000, wants to build 25 miles of good road at the cost of \$2,000 per mile. Including the per capita road tax and the usual levy, such a township now pays, say seven mills on the dollar, or \$2,100 per year for road purposes. It borrows the required \$50,000, paying for it \$1,500 per year, leaving \$600 a year for road repairs. By the contract system those 25 miles of road can be built in three years or even less.

Is this a chimerical plan? Is it rainbow chasing? If practical, does it increase road taxation? Is it accompanied with any danger, financially, to the township or to any individual taxpayer? In a word, if it is feasible wherein is it objectionable? It certainly places no more incumbrance on the property of the township than exists under the present system. With the present method of road maintenance, no person can look ahead to the time when there shall be less taxes levied for road purposes than now. This State is taxed annually in one way and another for road purposes at least \$2,300,000. This amount will take care of \$60,000,000 of $2\frac{1}{2}$ per cent bonds, and release them in seventy-two years, besides leaving half a million dollars each year for keeping the roads in repair. Continue on the same line as now, and in seventy-two years there will be nothing more to show for seventy-two years of taxation than there is now to show for the past seventy-two years of expenditures made on the roads throughout the country generally.

Whether the establishment of such a bureau and the issuance of such a bond are feasible or not, I am not prepared to say. It is claimed in high financial quarters that such a bond would command a premium and would be available for every description of investment that National and State bonds are throughout the world. Mr. Rhawn says, "If issued continuously, and to the extent they probably would be, they should at once settle the question of the life of the National banking system, supposed to depend upon the life of the present Government bonds, as they would be equally as valuable and acceptable as security for the notes of National banks as the Government bonds now are, which is a most important consideration; indeed, it would seem second only to that of the improvement of the roads."

But this plan of anticipating the payment of road taxes to obtain the means of building roads does not depend entirely on borrowing money of the Government. It can be borrowed of capitalists and associations engaged in loaning money, though the inability to borrow on long time at a low rate of interest might reduce the number of miles of road a township may at one time undertake to build. The plan, however, remains.

Economy is wealth. There may be a difference of opinion as to the kind of economy which creates wealth. The miser economizes, but the more economy of his kind the worse for the community in which he moves. But there can be no two sides to the nature of the advantages accruing to a people by getting rid of mud and making good roads. This \$8,000,000 saved annually in Iowa would cause the State to blossom as the rose. It would settle the question of the practicability of making Iowa a successful man-

ufacturing State. It would put an end to all differences between the railroads and the people, because it would solve the problem of cheap transportation. It would add materially to every man's ability to earn a living by making such a distribution of the millions saved as come naturally through the laws of traffic. It is just that kind of a saving which helps everybody and harms no one. It is the keynote of business economy. If a man gets along with one suit of clothes, one pair of boots, and one hat when his comfort and happiness requires and his circumstances permit two of each kind, and this economy is general, the business of the country becomes depressed, and failures are common. Such economy is not wealth. But let each man's share of the amount saved by building good roads equal the amount saved by economizing on clothing, and the country prospers and the people thrive, because the saving is taking from what is now absolute waste. France is financially stable and strong, and her people are busy and prosperous, because nothing is permitted to go to waste, and yet there is no country on the globe where the masses realize so much right down real enjoyment of the pleasures of life as the French. They have good stone roads in France and the Government built them.

There are times when the demoralized condition of the business of this country may be traced directly to bad roads. Stringency in the money market may be attributed as often to bad roads as to any other cause. Hard times, dull times, labor unemployed, fluctuating prices, reduced railroad earnings, spasmodic speculation in stocks, corners in meat and breadstuffs, are often the immediate results of bad roads. Mud, besides being a rapacious fiend, is a hard-hearted king. R. G. Dun & Co., of New York, in a recent review of the condition of trade, says that "the stringency in money markets here and at some other points is more largely due to slow collections, which appear to result from severe weather and impracticable roads, than from any form of commercial unsoundness or inability to distribute products. * * * At Chicago, partly because of bad roads receipts of many products declined."

So it is that mud rules the land. It is a great conqueror. It is worse than an invading army. So great a foe requires the united efforts of the people to dethrone it. In this struggle every line of business in the land should be united, and there certainly is no interest which has more at stake in the success of this grand reform, or which should be more determined and active in urging the great work forward, than the National and State banks of Iowa.

United States Department of Agriculture.

OFFICE OF ROAD INQUIRY.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., February 5, 1897.

The accompanying consular reports on the "cost of hauling farm products to market or to shipping points in European countries" have been selected from among those received through the Department of State, in response to the request of the Secretary of Agriculture for such information, and in reply to circulars issued to the United States consuls by the Department of State. It is respectfully recommended that they be published as Circular No. 27 of this office.

ROY STONE,
Director of Road Inquiry.

Approved:

J. STERLING MORTON,
Secretary.

COST OF HAULING FARM PRODUCTS TO MARKET OR TO SHIPPING POINTS IN EUROPEAN COUNTRIES.

BELGIUM.

CONSULAR DISTRICT OF BELGIUM.

[George W. Roosevelt, consul.]

In compliance with Department circular dated November 20, 1895, I have the honor to report that, in the provinces of Brabant, Hainaut, and Namur, the principal farm products are cereals and beet roots for the manufacture of sugar.

As the average distance of farms from nearest railroad station is about 2 miles, the hauling distances are short.

Two horses usually haul a load weighing about 4,000 pounds from the farm to the station, for which the charge is 2 francs (\$0.38½.)

Mr. A. Dumont, of Chassart, the leading agriculturist in this section of Belgium, states in a letter to me that "It is difficult for me to tell the cost of hauling farm produce by wagon or cart, considering that here nearly all the transportation is done by railroad. We do a small

amount of hauling by horses ourselves. One horse can haul 1,000 kilograms (2,204 pounds) over and above the weight of the wagon or cart 25 kilometers (15½ miles) and return with a load in one day. The keep of the horse thus employed amounts to 4 francs (\$0.772) per day. This amount does not include the pay of the driver, whose wage varies according to locality and season from 3 francs (\$0.57) to 5 francs (\$0.965) per day.

ENGLAND.

CONSULAR DISTRICT OF LEEDS.

[Worfleet Haines, consul.]

I have made diligent inquiries, and can report that of course the cost of moving agricultural products in the West Riding of York varies according to the roads to be covered in the hauling, some being much more broken or hilly than others, and in some measure by the distance to be traversed; but taking the average around the city of Leeds, a two-horse wagon and driver will carry to the railroad stations each day during the week about 2¼ tons of 2,000 pounds (or 2 tons of 2,240 pounds, which is universally considered as a ton here) 10 miles from the railroad and return home the same day, prepared to repeat the trip the day following, and doing this six days in the week, the cost being 10 shillings, or \$2.40 in American money. This is considered the actual cost to the farmer; for, as one said to me, he could not do the hauling for hire for another at this price.

This distance is fixed upon as a standard by which to compare other distances. It is the distance which occupies the time of a man and two horses every day in a week; the cost of hauling from a greater or less distance from the railroad can be estimated.

These farm products are hauled from all distances—that is, from a half mile to as much as 10 or 12 miles in some cases, according to the distance of the farms from the various railroad stations. There is a great deal of discussion now about the building of “light railroads” into the districts far from the regular lines of railroad to lessen the expense of marketing farm products, with which the products of foreign countries, brought so cheaply by ocean freight, are competing so fiercely. It would be proper to say that the country roads around Leeds are the best I ever saw. They are metaled, or macadamized, and as soon as a rut starts in winter with heavy hauling it is filled with broken stones immediately, so they are never allowed to get bad. The horses used are the immense cart or shire horses of this country, as large and powerful as the Clydesdales or Norman Percherons used in the United States.

So it will be seen that everything is favorable to the hauling of the very large loads mentioned above. The country is rather hilly, though few of the hills are very precipitous. So the common estimate is one-third level, one-third uphill, and one-third down grade; the heavy pulling therefore being only one-third of the distance, and that on smooth,

hard roads summer and winter. Occasionally the roads are covered with melted snow frozen to slick ice for a few days; then sand and cool ashes are sprinkled on the part the horse walks on, so they, having calks on their shoes, get up the hills pretty well even then; but this occurs only on a few days at long intervals.

CONSULAR DISTRICT OF SHEFFIELD.

[Ben R. Bedle, consul.]

The markets for farm products in this consular district are Sheffield, Rotherham, Barnsley, and Retford. Tuesday and Saturday are the recognized market days. No farm products go to shipping points. The cost of hauling to market may be regarded as 8 to 12 cents per mile per ton, or 20 to 24 cents per hour. The average length of haul is 6 miles; the average weight of load for two horses is 4,480 pounds.

FRANCE.

CONSULAR DISTRICT OF HAVRE.

[C. W. Chancellor, consul.]

Efforts to secure satisfactory information upon the cost of hauling farm products have been almost fruitless. Transportation to this market is entirely by rail or water carriage, except for dairy and garden products of the immediate vicinity, for which there is no fixed rate of transportation.

This much, however, I have ascertained: The cost of hauling 2,000 kilograms 20 kilometers with one horse (it is not unusual to find one horse hauling 2 tons over the roads in France) and one man is 20 francs per day; with two horses and one man, 35 francs per day; cost per half day, 12 francs and 21 francs, respectively.

Cost of hauling flour a distance of 12 to 16 kilometers, 3 to 6 francs per ton, according to agreement.

COMMERCIAL AGENCY OF ROUBAIX.

[Styher H. Angell, commercial agent.]

From the barn to the market an average distance is 3 miles. The cost is for 2,000 pounds about 33.98 cents, or 11.33 cents per mile. The total cost of the haul from the field to market for a ton of 2,000 pounds is therefore 52.09 cents, the average distance being $4\frac{2}{5}$ miles, which would make the cost per ton per mile 11.85 cents.

For the haul in the fields and on dirt roads a two-wheel cart is commonly employed, the horses being hitched tandem. The diameter of the wheels is $55\frac{1}{2}$ inches, and the width of the tires is $4\frac{1}{3}$ inches. On graveled or paved roads a four-wheeled wagon is employed, the fore wheels being smaller than the hind ones. The diameter of the fore wheels is $32\frac{3}{4}$ inches, and that of the hind wheels is $55\frac{1}{2}$ inches. The width of the tires is as for the cart, $4\frac{1}{3}$ inches. A wagon of three

wheels is in vogue in this part of the country more or less, the diameter of the wheels and width of the tires corresponding with the last described wagon.

In this district there are a great many more paved than macadamized roads, though in adjoining districts and elsewhere in France the number of miles of macadamized roads exceeds that of paved ones.

GERMANY.

THE BERLIN CONSULATE-GENERAL DISTRICT.

[Charles de Kay, consul-general.]

Regarding the cost of hauling farm products to market or to shipping points in Berlin, I have the honor to state:

One farm, which I have taken as a sample, is the Rittergut Gross-Glienicke, in the East Havel district, since it is at the average distance from Berlin, say about 11 kilometers (6.8 miles). Mr. Wollauk reckons that a working day of a horse, including driver, wear and tear, shoeing, and care of wagon and harness, costs 3 marks 50 pfennigs. This is calculated on a team of two horses. If three or four horses are in the team, however, the average cost is lower for each. A horse hauling 1,250 kilograms, transportation for 1 kilometer (0.62 miles) on turnpike, 15.05 pfennigs (4 cents) per 1,000 kilograms (2,200 pounds). On country roads a horse can haul only half as much, therefore transportation for 1 kilometer on country road 30.1 pfennigs per 1,000 kilograms. If there is return freight to haul, the cost is diminished one-half. If hauling is done by outside help, add 20 per cent to cost.

An owner of another Rittergut at Klein Machnow, Mr. G. von Hake, has been kind enough to take from his books the following details and summary of the cost of hauling farm produce into Berlin, as well as the cost of maintaining horses, wages of drivers, etc.:

	Per year.
GRAIN.	
(1) Wages for groom	Marks. 180.00
(2) Board	210.00
(3) Insurance expenses	12.50
(4) Bed (4.50) and bedclothes (3), 10 per cent wearing out	7.50
(5) Feeding for two horses per day and per head:	Marks.
13 pounds=(a) 7,345 kilograms oats, at 1,000 kilograms, 120 marks.....	881.40
10 pounds=(b) 3,650 kilograms hay, at 50 kilograms, 2 marks.....	146.00
10 pounds=(c) 3,650 kilograms chopped straw, at 50 kilograms, 1.92 marks.....	138.20
10 pounds=(d) 3,650 kilograms straw, at 60 kilograms, 20 marks.....	121.70
(6) Veterinary surgeon and drugs for two horses.....	1,287.50
(7) Shoeing.....	10.00
(8) Saddler.....	30.00
(9) Wearing out of the stable utensils.....	30.00
(10) Carriage with box, 400 marks, 10 per cent wearing out.....	20.00
(11) Carriage with box, 400 marks, 10 per cent wearing out.....	40.00
(12) 4 per cent interest on 400 marks.....	40.00
(13) 2 good Danish working horses (1,600 marks), 10 per cent wear.....	16.00
(14) 4 per cent interest on 1,600 marks.....	130.00
(15) Stable building, 8,500 marks (for 2 horses=1,214 marks).....	64.00
(16) Stable building repairs.....	12.20
(17) 4 per cent interest on 1,214 marks (one-seventh of the stable).....	12.20
(18) Fire insurance, 1 per cent on 8,500 marks=8.50 and one-seventh.....	48.60
(19) Fire insurance, 1½ per cent on 8,500 marks.....	1.10
	2.40
Therefore one double team per year, at 300 days	2 184.00

	Peryear.
GRAIN—continued.	
Therefore one double team per day	Marks. 7. 28
Traveling expenses of driver .....	. 50
Toll tax .....	. 22
One load of 2,000 kilograms to Berlin, 15 kilometers	8. 00
One load of 1,000 kilograms to Berlin, 4 marks, or for 1 kilometer (one-fifteenth) .....	. 26 $\frac{2}{3}$
POTATOES.	
Cost of maintaining one double team per day	Marks. 8. 00
Wearing out of the bags	2. 00
Total	10. 00
Load 2,000 kilograms, therefore 1,000 kilograms 15 kilometers to Berlin (15 kilometers = marks 5) = 1 kilometer, one-fifteenth, or .....	. 33 $\frac{1}{3}$
HAY.	
Cost of maintaining one double team per day	8. 00
Load 1,000 kilograms to Berlin, 15 kilometers, 8 marks, therefore 1 kilometer, one-fifteenth, or .....	. 53 $\frac{1}{3}$
STRAW.	
Cost of maintaining one double team per day	8. 00
Load 2,000 kilograms to Berlin, 15 kilometers, therefore 1 kilometer = one-fifteenth, or	4. 00
MILK.	
Cost of maintaining one double team per day	8. 00
Load 400 liters, therefore 100 liters, one-fourth = to Berlin 15 kilometers, therefore, 1 kilometer, one-fifteenth, or .....	. 13 $\frac{1}{3}$
RECAPITULATION.	
1 kilometer, 1,000 kilograms load:	
Grain .....	. 26 $\frac{2}{3}$
Potatoes .....	. 33 $\frac{1}{3}$
Hay .....	. 53 $\frac{1}{3}$
Straw .....	. 26 $\frac{2}{3}$
1 kilometer, 100 liters load, milk .....	. 13 $\frac{1}{3}$

Oberamtman Ring, a member of the Prussian legislature, whose property is at Zehlendorf, near Berlin, estimates as follows: Cost of hauling on hard macadam roads, average for each horse, daily, 3 marks. This includes pay of driver, feed, and wear and tear on horse, wagon, and harness. To haul 5,000 kilograms 15 kilometers, 12 marks. To haul 60 hundredweight for 2 horses, 100 hundredweight for 3 horses; 1,000 kilograms 1 kilometer, 16 pfennigs. For bulky freights, such as hay or straw, these figures should be doubled.

FRANKFORT-ON-THE-MAIN CONSULATE-GENERAL DISTRICT.

[Frank H. Mason, consul-general.]

The following report is based upon the results of personal inquiry among farmers and upon official information furnished by the board of market supervision in this city:

1. Grain, potatoes, fruits, and other farm products are brought to Frankfort in wagons from a district having a maximum radius of 12 miles, and the average length of haul is estimated approximately at 8 miles.

2. The full wagon load for two horses varies, according to the direction from which it is brought, from 3 to 3 $\frac{1}{2}$ metric tons (6,720 to 7,840 American pounds). Roads leading into Frankfort from the east, west,

and south lie on the level river plain, while those from the north and northeast traverse a district more or less broken and hilly, and therefore include grades where 3 tons form a maximum load for a pair of strong horses. All public roads in this region are finely graded, macadamized, and kept in perfect condition throughout the year. The worn portions are repaired in the autumn or winter by covering with a layer of finely broken stone, which is rolled firm and smooth with heavy steam rollers. In wet seasons the mud is scraped from the roads into piles and hauled away, the same as is done in the care of city streets.

3. The average cost of hauling depends on two circumstances—the season of year and the length of haul. The roads being quite as good in winter as in summer, it follows that in winter, when farm horses are comparatively unemployed, wagon transportation is cheaper than in the other seasons, when they are needed for the ordinary work of the farm. But a fair average for all seasons is 16 cents per ton per mile for distances of 5 miles or less, from which figure the rate declines proportionately to 10 cents per ton per mile for a haul of 12 miles.

THE CONSULAR DISTRICT OF HANOVER.

[E. P. Crane, consul.]

The roads in this province are in general good. Their maintenance is provided for by what can hardly be regarded as a system, the traditions of one system of roads being different from those of another, giving rise to a different treatment. Some of the lines, for example, are cared for entirely by the province; and where this is not the case there are generally grants made by the provincial authorities in aid of the community more immediately interested and active. So it may come to pass that two villages, not satisfied with the accommodation afforded them by the roads already in existence, will come to terms for a new road or an improved condition of the road already maintained by the kreis (county) or the province, very likely appealing to the kreis or the province for a subsidy.

Loose as the method is, involving, one would say, so inevitably the effects of a divided and therefore unlocated responsibility, as a matter of fact the roads here are, as stated, so far as regards those that are at all of the nature of a thoroughfare, very good.

As to grade, while we have a low range of hills to encounter, there is so much of the land that is level, and that the part that is mostly cultivated, that grade may be left mostly out of consideration.

All this being understood, I may proceed to answer the question put in the circular.

The maximum haul for a good team is about 6 tons for an all-day haul, say about 10 to 12 English miles. The average haul would not differ very much from this for the obvious reason that the farmer will do his best to make the trip to the railway only for a load that is worth his while.

The cost of keeping two good horses, with repairs, sinking fund, etc., is estimated to me at 3,000 marks (about \$750). This includes the wages and keep of the driver.

Now, if we take into consideration what I may call the extreme case—that of the farmer about 10 miles away from his point of delivery—and assume the correctness of the above estimates, we have, for the year, 18,000 ($300 \times 10 \times 6$) ton-miles of service for the cost of \$750, being about $4\frac{1}{8}$ cents per ton-mile.

How little enlightening such an estimate is will at once appear to the practical man, inasmuch as—to exemplify only one or two vitiating considerations—the wagon can not be supposed to be engaged the whole year in this service, so that everything depends upon the profitableness of its intermediate use, while the greater number of the farmers do not happen to live at distances from market corresponding to the most economical disposal of the possible day's work for their teams—that is to say, just 10 miles or aliquot parts of that distance.

These approximations, however, rough as confessedly they are, may nevertheless be of some value, if in no other view than that of showing the economy of well-kept roads.

The force of this remains unweakened when the confession is made that the farmers here find the tax of transportation under the present system too heavy in view of the close economy they must practice at the very best to meet the intense competition of the present day. Hence there are springing up in this province, as elsewhere in Germany, other means of transportation, of what may be called a secondary railway character. If information upon this head is desired, it would give me pleasure to put at the disposal of the Department such as I have been and shall be able to gather.

CONSULAR DISTRICT OF BRUNSWICK.

[E. W. S. Tingle, consul.]

Low as the cost of transportation of farm products from the farm to market or to the railroad station is in Germany, it is especially so in the Duchy of Brunswick. This is due to the fact that among the splendid macadamized roads of Germany those of Brunswick are easily first, the nearness of the Harz Mountains permitting stone for macadamizing to be laid down anywhere in the Duchy at slight cost.

The cost of transportation differs somewhat in individual cases, but that reckoned by the more important farmers (Rittergutsbesitzer), who farm on a scientific basis, leave nothing to guesswork, and calculate units of cost in the smallest details of the varied operations carried on their farms, may be taken as a standard.

These farmers use a cumbersome wagon, of great carrying capacity, however, weighing between 2,000 and 3,000 pounds, upon which they load about 7,000 pounds.

The teamster is usually a permanent employee of the farm, receiving free board and lodging and cash wages of about \$14 per month.

The average distance from the farms to the markets—that is to say, to the larger towns, or sugar-beet factories, or to the railroad station—is from 4 to 8 kilometers, or from $2\frac{1}{2}$ to 5 miles, by macadamized road.

The wagons cost from \$100 to \$150 and last practically a lifetime. The horses will average \$200 in cost, and well handled can be expected to give at least six years' good service. Two horses are harnessed to each wagon when the hauling is done on a macadamized road. With these items of first cost the closest and most accurate reckoners calculate the cost of hauling 1 ton 1 kilometer (five-eighths of a mile) at about 30 pfennigs, or 7 cents, or 11 cents for 1 mile.

COMMERCIAL AGENCY OF PLAUE.

[Thomas Willing Peters, commercial agent.]

I think I can best answer the questions of the Secretary of Agriculture by giving the amounts that are allowed by the German Government for hauling farm products during the military maneuvers.

There are two classes who do the Government hauling: The professional carter, who receives for his team, wagon, and driver 12 marks per day (\$2.85), and who makes one trip of 2 German miles, hauling 4,408 pounds, and the farmer, who receives a little less per pound than the professional carter.

The amount paid by the Government is calculated per pound and distance.

Professional carter receives (distance, 2 German miles equal $9\frac{3}{8}$ English miles; weight, hauling 1 German tonneau of 2,204 English pounds and 6 ounces): 6 marks (or \$1.43) for every 2,204 English pounds. Cost per mile for 2,204 English pounds, 14.77 cents.

Farmer receives as compensation (distance, same as above; weight, same as above): 5.50 marks (or \$1.31) for hauling 2,204 English pounds $9\frac{3}{8}$ English miles. Cost per mile (English), 13.54 cents.

So low are these prices that one can hardly credit them, and if I had not received the information from an official source I could not believe them to be correct.

It should be taken into consideration that the time in which the hauling is done is in the autumn when there is a lull in farm work. It is quite possible that in winter and midsummer the prices would be greater. Private parties contracting for the same weight and distance would, I have no doubt, have to pay more, but on this subject I can get no reliable information.

Here is the official information from which I have made my calculations for the price paid to farmers: Average length of haul in German miles, 2; average weight of load for two horses, 20 centner; for two horses (75 pfennigs each), 1.50 marks; for driver, 1 mark; average expenses, 3 marks. Total, 5.50 marks.

The possibility of the above figures can only be accepted when we take into consideration the wonderful perfection of the Saxon roads, which are tended as our park roads.

CONSULAR DISTRICT OF MANNHEIM.

[Max Goldfinger, consul.]

The average length of haul is 20 English miles. The average weight of a load for two horses is 6,000 pounds, or 3 tons. The average cost per ton (of 2,000 pounds) per mile is 50 pfennigs, or 12 cents, at the rate of 4.20 marks = \$1.

CONSULAR DISTRICT OF MUNICH.

[Ralph Steiner, consul.]

Hauling rates are not fixed by law, every forwarding agent or teamster making an agreement with the parties desiring his services. These agreements are private contracts, and consequently hauling rates are to a great extent determined by competition, the condition of the roads, distance of haul, and the character and weight of the load.

Owing to the numerous railways and shipping points in this district, it would be difficult, if not impossible, to determine with any accuracy an average length of haul. It may be stated that the distance of haul ranges from one-third to 45 miles.

An average charge for hauling farm products from the place of harvesting to market, or shipping point, is from 5 to 7 cents a ton per mile. The average weight of load for two horses is 11,000 pounds.

It is not customary, on freight hauled from the railway station in Munich to points within the city, to charge for the distance traversed, but according to weight and character of load, e. g., cereals in sacks, 21 to 26 cents per ton; peat, 38 to 43 cents; flour, 39 to 43 cents; wood, 32 to 39 cents; stone, 26 to 32 cents.

THE CONSULAR DISTRICT OF STETTIN.

[F. W. Kickbusch, consul.]

Farm products in the districts of this consulate are sent to market or to shipping points mostly by the farmers' own teams at times and periods of the year when there is no other work or employment at the farm for them. The hauling in this way being done privately and at times, as before mentioned, when the teams lay idle, the real cost can not be ascertained.

When teams of horses are employed for hauling farm products, the costs vary according to the state and condition of the highroads and country roads, so that no fixed rates can be stipulated, for while on a good road a farm team can draw 60 to 80 hundredweight, only half of this amount could be carried on country roads; much depending also from the influence of the weather and season.

I might mention that principals of this enterprise for hauling farm products were compelled to give up their business, owing to the competition of the railroads.

A few years ago in the town of Stargart, a distance of about 20 miles

from Stettin, farm products were carried to and from Stettin and from door to door at the rate of \$1.50 per ton, or $7\frac{1}{2}$ cents per cwt., while the railway only charged \$1.25 per ton, or $6\frac{1}{2}$ cents per cwt.

Here the carrier's business had ultimately to be given up, because it no longer paid, customers finding that their goods were not sufficiently cared for, there being losses, differences of weights, bad protection against weather, etc.; so they decided to favor the railway.

My inquiries as to the direct interrogatories contained in your circular were in vain.

ITALY.

THE CONSULAR DISTRICT OF MILAN.

[D. B. Spagnoli, consul.]

For the transportation of all kinds of farm products to the market of this city of a two-horse-wagon load of the usual weight of 4,000 kilograms, say the distance from 10 kilometers to 20 kilometers (a kilometer equal to five-eighths of an American mile), the general cost is 20 lire (an Italian lire is equal to $19\frac{1}{3}$ cents American standard; 20 lire equal to \$3.86), and about 0.25 lire per kilometer for every 1,000 kilograms weight.

The roads in this district are all kept in a first-class order and the most of them are macadamized, which renders the hauling easy.

CONSULAR DISTRICT OF CATANIA, SICILY.

[Louis H. Bruhl, consul.]

In this country, two-horse wagons are little, if at all, in use for hauling products to market or shipping points; all the freighting being done with large, heavy carts drawn by one horse or mule excepting some low, four-wheeled trucks employed in the city and for carrying the large casks of wine from the neighboring towns, off the railroad, to Catania. These trucks are also drawn by one horse or mule only.

The average length of haul by cart or truck is about 20 miles.

The average weight of load for long distance is about 1,500 pounds, more or less, depending upon length of haul and condition of road, whether in the plain, upon nearly level ground, or in the mountainous district.

Cost of hauling¹: The teamsters furnish their own animal and cart and are paid by the trip, generally averaging from 6 to 7 lire, or American \$1.08 to \$1.26 (figuring 1 lire depreciated currency at 18 cents American gold) per day.

Grain and seeds: For example, from Lentini, which is situated down in the plain, distance about 18 miles, requiring seven to eight hours drive to Catania, pulling 1,500 pounds, the freighter receives 5.50 lire,

¹The freighters frequently have merchandise to take as return freight, at probably better rates, thus making their trips more profitable.

or 99 cents American gold—making $7\frac{1}{3}$ cents per ton of 2,000 pounds per mile. From Aderno, in the mountain district, distance about 25 miles, requiring nine hours drive (mostly down hill), pulling 1,500 pounds, the usual pay is 6.50 lire, or \$1.17, making about $6\frac{1}{4}$ cents per ton per mile.

Almonds, on account of greater value of cargo, pay a trifle more in proportion, about $7\frac{1}{2}$ to $7\frac{3}{4}$ cents per ton per mile.

Wine: The freighters leave Catania late in the evening for one of the wine-producing towns among the foothills of Etna. Each takes with him two large empty casks upon his four-wheeled truck and returns with them filled next evening to Catania, having to wait for the filling. Each cask holds about 585 American quarts and weighs about 1,650 pounds, making a load of the total weight of 3,300 pounds for the two casks (nearly all down-hill road). The freighter receives for the round trip as follows: To towns, average distance from Catania about 12 miles, 6 lire (\$1.08) per cask, for the load of two casks, \$2.16, making 10.9 cents per ton per mile. To towns, average distance from Catania about 8 miles, 4 lire (72 cents) per cask, for the load of two casks, 3,300 pounds, \$1.44, making also 10.9 cents per ton per mile.

Fruits, oranges, and lemons in boxes, from interior towns to Catania: From towns, average distance from Catania 25 miles, 40 centesimi, or 7.2 cents per box; 18 miles from Catania, 30 centesimi, or 5.4 cents; 15 miles from Catania, 25 centesimi, or 4.5 cents; 8 miles from Catania, 15 centesimi, or 2.7 cents.

Fruit, in baskets, from nearby orchards: 2 lire, or 36 cents per trip, when only three trips per day can be made; 1.25 lire, or $22\frac{1}{2}$ cents per trip, when near enough to allow 5 trips per day.

It will be seen that the average amount paid for hauling is always about 6 to 7 lire, or \$1.08 to \$1.26, per day for man, horse, and cart.

SWITZERLAND.

THE CONSULATE-GENERAL, DISTRICT OF ST. GALL.

[Irving B. Richman, consul-general.]

The longest distance over which farm products are hauled in wagons in this Canton and vicinity is about 25 miles. Taking 25 miles as the extreme length of haul, it may be said that the length of haul varies between 25 miles and 1 or 2 miles. Twenty-five miles is regarded as the extreme limit of haul per day. The cost of hauling per day, with a double team, for a load of from 50 to 60 hundredweight is from \$2.70 to \$3.10. According to this, it will be seen that an ordinary load for two horses in this Canton and vicinity is about 50 to 60 hundredweight. This, however, is the case only where the hauling is over comparatively level roads. Where the roads are hilly, an ordinary load for two horses is about 30 or 40 hundredweight.

THE CONSULAR DISTRICT OF HORGEN.

[William Streuli, vice-consul.]

Farming is not carried on in Switzerland in a sufficiently extensive style¹ to make a systematic business of the hauling of the products, or to justify statistical compilations about that kind of transportation.

There are not here, as in most other countries, wide plains planted exclusively with cereals, nor orchards covering a large area, particularly not in this consular district, which is hilly and mountainous throughout.

In the low parts, where farming, properly, other than wine culture and grass growing, or cattle raising, is prevailing, the railway system is expanded enough, with its many stations, which are only 1 to 2 miles apart, to be within easy reach of any farmer. In localities where larger quantities of grain or fruit are grown, the railway station is not beyond a distance of 10 miles from any farm, and the quantities reaped by one and the same farmer are proportionately small, there being but few large landowners in a country where the acre of grain-growing soil requires an investment of at least \$200.² As a rule, the producers haul the product to the station with their own team and calculate the compensation at \$2 per day and per horse, and at \$1.20 to \$1.60 for an ox or a cow, the driver always included.

On level roads a horse is expected to pull 12½ quintals (2,755 pounds English). The tractive power of ox or cow is taxed variably, according to the tendency just prevailing of seeking preference in the production of milk or in that of meat. Strong oxen pull 2,200 pounds.

The farm wagons in use are not specially constructed for a certain kind of load. They are frame, or so-called "ladder wagons," from which the ladders on each side can be removed when necessary, as, for example, for the transportation of a manure vessel or a wine barrel, or be substituted by a couple of boards put on lengthwise if the load is of a kind likely to escape between the rounds of the ladder.

A one-horse wagon is constructed to carry 4,400 pounds; a two-horse wagon 8,800 pounds. The average draft horse travels 24 to 28 miles a day on level, hard roads, with a load of 12½ quintals.

¹ With the only exception, perhaps, of wine growing.

² Meadows, \$234; vineyards, \$657.

United States Department of Agriculture.

OFFICE OF ROAD INQUIRY.

WASHINGTON, D. C., *March 2, 1897.*

SIR: The following addresses by the Director of the Office of Road Inquiry on road improvement in several States contain necessarily much repetition. I am unable, however, to correct this without destroying the unity of the various addresses, and as the leading statements made will bear much reiteration, I recommend that these addresses be published in their entirety as Circular No. 28 of this office.

Very respectfully,

ROY STONE,
Director.

HON. J. STERLING MORTON,
Secretary of Agriculture.

ADDRESSES ON ROAD IMPROVEMENT IN MAINE, NEW YORK, NORTH CAROLINA, AND ILLINOIS.

Address Delivered before the State Board of Agriculture, Augusta, Me.,
January 21, 1897.

MR. PRESIDENT, LADIES AND GENTLEMEN: It is due to the very courteous invitation extended me by the board of agriculture of the State of Maine that I have the pleasure of addressing you to-night. On my own part I represent, so far as I am able, the Department of Agriculture of the United States. It is proper, then, that what I have to say to-night should be addressed especially to farmers, and if I speak to the audience generally I mean it especially for the farmers in the audience, and not necessarily for the others. And yet all ought to be interested in what interests the farmers of the State of Maine.

The question naturally arises in your minds, What has the General Government to do with the question of the roads of the State of Maine? Away back in the early days of the Republic the building of roads was a very serious concern to the General Government. For fifteen or twenty years before the General Government began the improvement of rivers and harbors it had a great deal to do with the laying out and construction of roads in the United States. At that time the construction of rivers and harbors was thought to be a function of the States

and the construction of roads a function of the Government, but now they have changed places. The Government then laid out twelve or fifteen national roads throughout the United States, supposed to be a complete system of national highways, and on one road five or six millions of dollars were spent. Other roads were merely cut through the woods or blazed out; others were improved to a greater or less extent. In the course of time there came to be difficulties in the way of national road construction, some constitutional difficulties and some financial difficulties. The great crisis of 1837 put an end to nearly all enterprises in the United States, and it nearly put an end to the road building by the United States. The constitutional questions that were brought up about that time have never practically been settled, and yet the Government has in a small way gone on building roads ever since.

The feeling has been that the Government has nothing to do with the question of roads in the States, and no one took the ground that it had anything to do in that direction to any practical extent; but about four years ago this last autumn a number of us who have been working for good roads for a good many years in the United States individually, thought we would get together and form some kind of an organization. We formed an organization during the opening of the Columbian centennial proceedings at Chicago at the time of the dedication of the buildings for the World's Fair, which we called the National League for Good Roads. It happened to fall in with the general sentiment of the country at that time, and we were able to carry it on for a year by private subscriptions, and we raised and spent about \$10,000 in the campaign for good roads. In January four years ago we held a convention at Washington, and it was discovered that the Government took a very deep interest in what we were doing. Our convention was attended by Members of Congress, the Secretary of Agriculture, and a representative of the War Department, and it created so much interest in Washington that we ourselves were astonished. We had about 25 States represented by volunteer delegates, who paid their own expenses.

The Members of Congress who met with us said that we would not succeed in carrying this work on indefinitely by subscriptions and we had better get an appropriation. We were perfectly contented to have an appropriation, and from that time on the Government has appropriated about \$10,000 a year, through the Committee on Agriculture, and put it at the disposal of the Secretary of Agriculture. The Secretary of Agriculture, finding that this had been brought about by the work of the National League for Good Roads, decided to put the administration of this appropriation into the hands, as far as possible, of that league, and I was accordingly appointed to take charge of it, and that made me, very much to my astonishment, a Government official in the interest of good roads.

We have carried on, from that time to this, a steady investigation of

what was going on in the United States in the matter of road building. We have not had very much money, but we have had a great deal of voluntary assistance. A great many men all over the United States have helped us to gather information, and we find that there is a great deal going on in the United States, a great deal that very few people know anything about; a great deal going on in some sections that is not known outside the counties. And actually the question of road building is being solved in the United States to-day by the voluntary action of the people themselves in different sections of the country.

I am particularly delighted to see the State boards of agriculture and the farmers' organizations generally taking up this subject. I came directly here from a meeting of the State congress of farmers in New York. They devoted nearly the whole day yesterday to the question of good roads. They have determined to take the lead of the movement themselves, and not merely to take the lead, but to ask the help and accept the help of all the organizations that are willing to help them.

DONE LARGELY BY FARMERS.

The actual work for good roads in the United States has been done to a great extent by farmers. I do not mean the campaign of education and the agitation for good roads, but the actual preparation and the carrying out of measures for good roads have almost altogether originated with the farmers in the United States. The wheelmen have done capital work in stirring up public sentiment, but the practical working measures have been almost entirely organized by the farmers. The farmers of New Jersey, for instance, were the authors of the State-aid law in that State, and that is one of the best solutions of the good-roads problem that has been made anywhere. I will give you some details of it after a little.

The farmers have great reason to take up this question, and they have a reason that many of them have never thought of. It is due to them, in absolute justice, that the whole business of road construction should be remodeled and a portion of the burden that they have unjustly borne ever since the organization of our Government taken from their shoulders. The farmers of the country have been charged with the whole expense of building and maintaining the roads for all the people of the country. The farmers in the State of Maine own one-fifth of the property in the State, and that one-fifth of the property has paid the entire expense of building and maintaining the roads of State, which are just as necessary to the people who live in towns and the people of other occupations than farming as they are to the farmer. It is time that justice should be done in this matter. The farmers in the State of New York own only one-fourteenth of the property in that State. Every farmer in that State has been making roads for thirteen other men to travel on, and he is getting tired of it. He means now

that something shall be done to stop it; and as far as I am able to ascertain the people of the cities and large towns, the manufacturing people and the commercial people, are perfectly willing to bear their proper share of the expense of improving the roads of the country.

There are a thousand considerations that make it to their interest to do so. There is no need to go into these, since they have discovered them themselves. Any of them will tell you at once why he wants good roads in the country and why he is willing to do something toward obtaining them. The only drawback to-day is that the farmers themselves have been afraid to let any change be made in the road laws of the country. They have been afraid that the people of the cities have some design to impose upon them heavier burdens instead of taking off some which they already carry.

I will tell you what they propose to do in the State of Pennsylvania, where they have given a great deal of attention to this particular subject. Professor Hamilton, deputy secretary of the department of agriculture and professor in the State college, has given much attention to this question of road administration. He had himself chosen road supervisor for that purpose, and served in that capacity for two or three years. And he has been put into the department of agriculture in order that a reform might be made through the knowledge that he has acquired in the administration of the road funds of the State. He begins by having road days in all the farmers' institutes. Three hundred of these meetings will be held in the State of Pennsylvania this year. Three hundred days of the farmers' institutes will be devoted to good roads. I will give you Professor Hamilton's scheme in a few words, and I think it is a very good one. They are going very slowly and moderately but surely in Pennsylvania. They now spend \$4,000,000 annually in money and labor on their roads and the roads are not being improved, and they are tired of it. Professor Hamilton believes that if that money was well expended two-thirds of it could be put into permanent road improvement every year, and the other one-third would keep the roads in better condition than they are now, and at the end of nine or ten years they would have good roads all over the State. He says that in many districts of the State the supervisors are elected but for a single year. Any policy in road construction that might be adopted by such a board could not be fairly tested in so short a period, and consequently those in charge hesitate to begin any work of permanent improvement for fear they will not be continued in control for a sufficient time to demonstrate its value. A degree of permanency could be secured if the supervisors were elected for three years, one going out each year, and leaving the two old officers as a majority in control, giving time to the newly elected official to become acquainted with the system and understand its purpose before any radical change could be effected.

He says at least one-half of the road tax ought to be paid in cash.

I find that this system gives satisfaction in every State that has adopted it, and I have no doubt that you have progressed here in that direction to the extent that you will at least be able to have one-half of that tax paid in cash in all the towns of the State.

SHOULD BE PUBLIC SPIRITED.

Professor Hamilton also has an idea that these road officers should not be salaried officials, but the best citizens of the town who are willing to serve the public, and that they should not themselves be expected to go to work on the road or even to call a force to go onto the road or to expend money, but they should hire the best men they can find and carry on the road work just as you would carry on any other work that belonged to the community. Then the man who actually calls out the men to work on the road and who spends the money that is allotted to him has no fear of the good or ill opinion of the persons he employs; he is not looking for election next year—for another soft job. And the result will be that this man who is paid can call out the labor and work it to the same advantage that the farmer would work his own hired men. There are a number of other provisions in that bill in the same direction.

I will send the bill to you, and I think it will be worth while for your committee to take it into consideration when they are considering any bills for the administration of roads.

Among the matters that we have investigated with the utmost care is the actual cost of bad roads or the advantage of good roads. That subject has been examined from a good many points of view by a good many different people and not more astonishing is the amount of this tremendous tax than the agreement in reaching that amount from so many different sources. The secretary of the National Farmers' Congress, who is a very bright statistician, worked it out from his point of view, taking the railroad returns of freight and the amount of it that was hauled over the public roads. He makes the needless cost of moving the farm products of the United States—the cost beyond what it should be—to be \$600,000,000 a year. Professor Latta, of Purdue University, investigated it from the point of view of the farmers of Indiana. In that State they have some good roads; not the highest class of roads, but about 10,000 miles of very good gravel roads. Professor Latta worked it out, and found from the reports of the farmers themselves—those who lived on the good roads and those who lived on the bad, and those who had lived on bad roads before they were made good, taking their average opinion—that the difference between good and bad roads was 78 cents an acre annually on their farms. This, taken all over the farm area of the United States, would make \$500,000,000. The farm area is a little over 1,000,000 square miles, or about 650,000,000 acres.

The author of the Highway Manual of the State of New York took

it up from the experience of a single farmer in the State of New York, and he made it \$1.25 an acre. I took it up from another point of view, or at least I took a broader view of it. I sent out letters to the 10,000 farmers in the United States who had been selected as the best representative men to gather statistics for the Department of Agriculture. I got a great number of replies and averaged them. We took the census returns as to the amount of farm products, and these men gave us the average cost of hauling their products to market, and the products of their neighbors, as far as they could judge, and from these we got the actual cost of hauling. I took the proper cost to be the present cost to the farmers in the good-roads district of New Jersey, where there are actually as good roads as are found in any part of Europe. The cost of hauling over the ordinary roads of the country is just about three times as much as the cost of hauling over good stone roads, or, in other words, these costs are in the proportion of three to one. Where a load is 3 tons on good roads it is 1 ton on the average farm roads. The average cost of hauling 1 ton a mile throughout the United States is 25 cents. In the New England States it is 32 cents, they being more hilly and having generally worse roads. The cost in New Jersey runs from 7 to 10 cents.

LOSS BY BAD ROADS.

The actual extra cost of moving products is not the only loss by bad roads by any means. Farmers lose by not being able to get to market when the market is good, by the waste of products that can not be marketed at all on account of bad roads, by not being encouraged to cultivate things that require a speedy market, and in a great many other ways. The actual money loss to the farmers of the United States by the bad roads of the country is not less than one-fourth of the total home value of all their products. The total home value of the annual products of the United States farms is about \$2,500,000,000, and the loss by bad roads is about \$600,000,000, so that the farmers lose, or they would lose if they could stand all that loss themselves, one-fourth the value of all their products by the extra cost of getting them to market.

They do not pretend to be able to stand all that loss themselves. They stagger under it as well as they can, and bear all they can of it, and the rest they saddle upon the consumer and the dealer. That is one reason why the people of the cities and towns are beginning to understand that they are interested in good roads. One reason why the boards of trade and the commercial bodies in the United States are getting interested in good roads is the fact that the whole business of the country is suffering for the want of good roads. The Chamber of Commerce of the State of New York expresses it in this way:

The movement for good roads deeply concerns every commercial and financial interest in the land. We are handicapped in all the markets of the world by an enormous waste of labor in the primary transportation of our products and manufactures

The question of State aid is one that suggests itself to you naturally, and is probably the most important one to be considered. The best method of getting at State aid that has been developed as yet is the New Jersey plan. It is better to let your road improvement begin in a small neighborhood than to require action by a county board, or even a township board. In New Jersey it begins with a petition by the property owners along any particular piece of road. If they come together and say that they are willing to be assessed for 10 per cent of the cost of improving the road, the county goes on and improves it, and the State pays one-third the cost. You do not have to start with a whole county, and there is no opportunity for local jealousies, no question as to whether it should be this road or that road or the other road, or which ought to be the principal township or county road. The people who are willing to help themselves are the first to be helped, and that is the best method I have seen anywhere of starting road improvement. I would recommend that the local contribution should be increased to one-third, and that it should extend over all the area that is drained by that particular road—all that is directly benefited by it. The benefits are extended to people who come in from the side roads, and you will find that the actual benefited district of a road can be marked out just as accurately as the drainage area of a stream. You can see where the travel is coming from, and you can tell in one year just how many people ought to contribute to the cost of it. I believe you would be able in the State of Maine to find plenty of wide-awake neighborhoods that would avail themselves at once of a State-aid law of this kind. You do not have to organize any boards, but simply call a meeting of neighbors to sign a petition for the improvement of the road, and agree to pay in proportion to the benefits received, those along the road paying more than those back a mile or two.

CHANCE FOR NEIGHBORHOOD RIVALRY.

I only give you that as an outline, because it is not practical yet, as I understand the condition of things here, to go into that line of legislation; I suggest it as a method by which State aid may come in without exciting local jealousies and without waiting for the education of whole communities, like a county or township, so that a wide-awake, smart, energetic neighborhood can get the benefit of State aid and of the county or township aid and not do any injustice to its neighbors. It is perfectly proper that those who are willing to help themselves should be helped, and those who are first ready should be first helped, those that come in afterwards taking their chance of getting in on the next appropriation. The effect of this distribution of State aid in New Jersey is to make public opinion prompt and active for more appropriations and for more road work the next year. The appropriations have been continually increased in that State, as in Massachusetts, which has followed the practice of distributing the work all over the State in order to have object-lesson roads and create public sentiment. At first

some of the farmers in New Jersey were opposed to the method, but now they jump over each other to get in their applications, for they see the benefit of it.

GOOD ROADS LEAD TO WEALTH.

Good roads are the highways to wealth. If I could take you with me North, South, East, and West, to where the beginnings of road improvement have been made, I could show you small farming communities growing rich in these hard times, contented and happy, and troubling themselves not at all with the great problems of finance which agitate their brethren. They have no time to waste in talk. If their fields are too wet to work they go on the road. Their marketing is done in bad weather, and in rainy spells they bring from a distance cheap fertilizers to enrich their farms, such as marl, city refuse, etc. Philadelphia refuse is carried 20 miles on the stone roads. In these fortunate communities every day brings its earnings to man and beast, for there is always paying work on a good road, and if a man has no hauling of his own to do he can get work from others, and good wages. Extend these conditions and imagine, if you can, the prosperity that would burst upon the country if every farmer and every farm team could earn a fair day's wages for every day in the year, rain or shine; if every farm could be cultivated and improved to its utmost extent.

It is not an uncommon thing in France to see a farmer 40 or 50 miles from home in wet weather with a heavy load. If he sees a prospect of a three days' rain, he puts his tarpaulin over his load, a cover over his horses, and a waterproof coat on, and starts off to market. He may go 50 miles before he finds a market that suits him, or he may know in advance just where he is going. You do not often see anybody driving 50 miles through a rain storm in the United States to find a market for a load of hay, but it is not at all uncommon to see farmers' wagons 40 or 50 miles from home there. They choose the wet weather for that purpose. Their roads are just as good then as at any time.

When I first began this inquiry I heard incidentally that there were some especially good stone roads being built in Canandaigua, N. Y. The people of New York outside of that village did not know anything about it, and I could hardly believe the stories that I heard, so I went there myself, and to make sure that I should make a thorough test, I went in the midst of a January thaw. I got a pair of horses and a light buggy to test other roads around the country, and I found that with a great deal of difficulty I could drive over them. I went onto these farmers' stone roads, and I found that they were hauling 2 tons of hay with two ordinary horses on a common narrow-tired wagon. I said to them, "How did you get started in this business of building roads?" They said, "We started it ourselves. We thought we could do something, as our fields are full of stone, with stone fences along the road, so we scraped together enough money to buy a rock crusher, and we hired an engine to run it, and made arrangements with the farmers to bring in

the stones and haul back the crushed stone." They have built in that township every year for the past four years from 3 to 5 miles of this character of road, and they have done it by direct actual taxation on their own property. They have petitioned the legislature for the privilege of increasing their taxation beyond what the law allowed, and the result is that all the farmers in that town are anxiously waiting for the roads to be extended into their particular neighborhoods. I said to them, "Doesn't this pile up your taxes?" "Why," one farmer said, "in this one week, by the advantage of having these stone roads and getting to market with my hay when it sells at a good price, my teams have earned \$5 every day, while my neighbors' teams on the other roads are eating their heads off. We could not afford not to have these roads; we do not care anything about the taxation." There is an instance in which the people took the bull by the horns. But it is not necessary to do that. I only relate this instance to show how great are the advantages of good roads.

ABOUT CONVICT LABOR.

I have one thought that I want to throw out here for your consideration. I have been looking at the question of convict labor in this State. I do not know whether your convicts in the State prisons are satisfactorily employed, but if they are you are very much better off than the people in other States. In New York, in the Sing Sing prison, we have 1,000 able-bodied men marching around for exercise because our labor organizations are not willing to have them compete with them. California was in the same situation. I went out there two years ago at the governor's request and looked over the situation. I said: "Why don't you put your convicts at work quarrying stone and preparing material for the roads of the State?" They passed a law authorizing the employment of convicts in that way, appointed a State highway commission to take charge of it, and put their convicts at work quarrying stone. At the Folsom prison they have a vein of trap rock which runs through the grounds, a splendid water power, and a railroad running into the grounds—every opportunity for turning out road material. They are actually furnishing to-day prepared road material to the counties of the State at 25 cents a ton, which is a little more than one-fourth, perhaps one-third, of the ordinary market price for road material. They were able to make an arrangement with the railroad companies for carrying that material at an equally low price, so that first-class road material is being delivered in the counties of California for less than you could buy it at almost any quarry. I do not know why something of that kind would not be practicable in this State. I am sure that it will be done in the State of New York, and I do not know why it should not be done here if you have any trouble with your convict labor. In many of the Southern States the jail prisoners are employed in road making, some in quarries and some out on the roads. I do not recommend a chain-gang business of any sort, but I do decidedly recommend

that the idle men in the jails and prisons should not be supported by the labor of honest men outside when they can be put to work in improving the roads for the country.

I think I have said enough, perhaps, to direct your attention to this matter, and I shall be very glad to answer any question that has occurred to anyone in this connection. I shall be glad to send from Washington the publications of our office, which have become almost a library by this time, to anyone who takes interest enough in them to send for them.

I hope you will give this matter a great deal of thought, and carry it home and talk it over among your neighbors and friends, and that you will be able to improve the highways and byways of this State until at some time not far off it can be said of your beautiful Commonwealth, "Her ways are ways of pleasantness, and all her paths are peace."

Remarks at the Hearing by the Committees of Senate and Assembly at Albany, N. Y., February 25, 1897, on the Higbie State-Aid Road Bill.

GENTLEMEN OF THE COMMITTEES: I appear before you in the double capacity of a citizen of the State of New York concerned for many years in the improvement of its highways and of a Government official charged with the promotion of road improvement throughout the United States. As a citizen of New York I am anxious to see my own State brought to the front in this great movement, and as a Federal official I am equally anxious for the Empire State to take its proper position of leadership and influence in the work. I am asked wherever I go, "What has New York State done for good roads?" and I am obliged to answer, "Very little but to pass a county-road bill, which has proven of no avail."

NEW YORK'S OPPORTUNITY.

The present active campaign for good roads had its origin largely in the national league, which was organized and had its headquarters in the State of New York, and was supported in great part by the contributions of her citizens. The national league in turn engaged the General Government in a renewed interest in road improvement, and many States in the Union have been stimulated through its action to some practical steps in this reform. The State of New York has had no visible benefit from its good-roads agitation, but the time is fully ripe now for practical results in this State.

I congratulate you, gentlemen, upon having an opportunity which rarely comes to any legislative body. You are here to reap the fruits of all the good seed the friends of good roads have sown for years past throughout the State. You are here backed by a powerful public opinion, which will justify you in righting the oldest wrong and lifting off the heaviest burden that oppresses the farmers of this State.

OUR UNJUST ROAD SYSTEM.

Our whole road system has been an evil inheritance from the mother country, a system which that country long ago shook off, but to which we have blindly held fast. By that system a small fraction—less than one-tenth—of the property of the State has been charged with building the roads for the use of all the people of the State. Other States in the Union are already shifting a portion of this burden upon the shoulders of the whole people, where it properly belongs. This they are doing through the medium of State-aid laws and the use of convict labor for road improvement.

It is true that some farmers oppose this legislation, but the opposition is only among those who have had no opportunity to know what the State-aid and convict-labor laws are doing for the farmers in other States. Those who have had that opportunity are in favor of having the same help themselves. I have taken pains to have this system explained to as many farmers as could be reached by an active special agent following up the farmers' institutes in the State during this whole winter. He has been through more than half of the agricultural counties, and wherever he has been there is now a strong and almost universal sentiment in favor of State aid to road improvement.

It is only by a State-aid law that the city population can be enabled to give farmers the help they are willing to give, and which justice requires them to give. Strict justice would require, in fact, that the State should pay the whole cost of road building and maintenance, instead of one-half, as is proposed by this bill. The whole people have equal rights in the use of the roads, and they have substantially equal benefits from them, for, though the people in cities may rarely use them, they are used constantly for the cities' benefit; without them the cities could not exist for a day; destroy them, and the people of cities and towns must scatter instantly to find subsistence.

LOSSES AND REMEDIES.

Taking into account only the period since the war of the rebellion, the farmers of this State have expended almost \$100,000,000 in money and labor on the roads of the State, and have practically nothing to show for it to-day; while at the same time the whole people in the cities and country have lost many times that amount in the extra cost of hauling the products of the State over bad roads.

This is clearly a case of bad government. Nothing is needed but good legislation to provide a prompt remedy. Fortunately for you and for the people of the State, you are in a position to provide that legislation and to make no mistakes in doing it. You are not obliged to undertake any experiment, nor to go any further in the abstract study of the subject; your course is mapped out by the experience of other States. The whole question is being practically solved in many places, without hardship to anyone and with benefit to all. You can

not expect to provide all the legislation that is advisable at this session, but you can provide all that is necessary for a beginning.

If the State-aid bill which passed the assembly three years ago had become a law, this State would now have been far on the road to the front in the good-roads movement. You would have had object-lesson roads scattered all over the State, and those roads would have done the rest. The bill which is before you to-day is of the same general character and should accomplish the same result. It is a very just bill and a bill which prudently avoids the development of local jealousies. It gives the State help first to those localities which are first ready to help themselves. It is practically a premium upon intelligence, enterprise, and self-help. It does not wait for the education of whole counties, but will help any neighborhood that is sufficiently alert to see its own interest in giving its own help to road construction. I would not advise pressing the bill for changing the road tax from labor to money at this session. It will be time enough for that when there is a stronger sentiment for good roads throughout the State, and that sentiment will grow apace when good-roads construction begins under the State-aid law.

FARMERS' OPPOSITION.

It is not safe for you, gentlemen, to say that the farmers do not want this legislation and proceed to kill it without further consideration. The farmers want anything that is just and right which will relieve them of a share of their burdens and help to restore them to prosperity. They know they are suffering grievous hardships which demand relief, and they have selected you and sent you here to find ways and means to better their condition. They give you the power; they give you opportunities which they can not enjoy; and they must expect you to seek the widest knowledge obtainable on this subject and to act upon it for their benefit, as they would do if they were here themselves. They have a right to demand as good legislation at your hands as the people of any other State are enjoying; and, if the farmers are prospering anywhere in the United States, they have a right to require that you should find out where and how they are prospering, and then give New York farmers the same chance.

I can assure you that farmers are prospering in many places in the Union to-day in the midst of these hard times, and where they have had no advantage over the farmers of New York, save in the wisdom and courage of their legislators, who have given them good road laws and good roads, sometimes at their own request, but as often in spite of their protest.

What chance have the majority of our farmers had to master this subject? What proportion of them have ever seen a perfect country road, as good through the spring and autumn rains or a "winter breakup" as in the driest summer weather? How many of them believe that such a road can be brought to their own doors almost without

effort on their part? How many realize the cruel injustice that compels them, the owners of a small fraction of the property of the State, to build and maintain the highways that are necessary to all the people of the State; more vitally necessary, in fact, to the cities than to the country, for the farmer could live on what he raises, while no city man could live on what he raises? How many of them have had occasion to learn that this system is a relic of barbarism and feudal oppression, long since thrown off by the farmers of the Old World?

LOSS OF HOME MARKETS.

Agriculture ought to be more prosperous in New York than in any other State of the Union. The great cities and towns of the State would make a home market for more than its farms can produce, but, for the want of good roads, reliable all the year round, the New York farmers have no command of their own markets, and the produce dealers, even in the interior cities and towns, having no certainty of a regular supply from the surrounding farms, are obliged to have recourse to other States and Canada for their supplies, and the farmer, when he is able to get to market, generally finds it forestalled and himself obliged to ship to some distant point, while the farmers along the railroads of the far West or on the good wagon roads of Ohio, Indiana, New Jersey, and Canada are supplying his home market.

Taking all these things into consideration, therefore, I earnestly beg you, gentlemen, not to let this magnificent opportunity to render the State a service slip away from you, and let another session of the legislature pass without definite and practical provision for the improvement of our highways. If the Empire State can not take the leadership in the march of progress, prosperity, and civilization which belongs to it by right of its wealth, its numbers, and its name, I trust you will at least make an effort to put the State somewhere in the procession.

MODIFICATIONS—CONVICT LABOR.

No one will insist, of course, upon your following the exact lines of this bill. You know best what legislation is practicable at this session. If the salaried commission is a stumbling block, a commission composed of three or four of the high State officials and as many citizens, who are willing to serve without pay, would answer the purpose of inaugurating this movement.

If the tax feature is objectionable, you can perfect and pass this bill without it and leave the matter of funds to the appropriation bill. An appropriation equal to 5 cents per head of the present population of the State would give quite a sufficient fund to start this work. Even a postage stamp per head, which would amount to about \$140,000, would do enough to insure the speedy success of the movement, especially if you should supplement the proposed bill with one providing for the preparation of road material by the convicts now idle in our State prisons and its proper distribution as an additional measure of State aid.

The success of road improvement in the State will depend very largely upon the selection and supply of a suitable surfacing material to support the actual wear of the traffic. Almost any common stone from fields, fences, or quarries will serve for a foundation, provided first-class and uniform surfacing material is supplied, whereas if the roads are made wholly of local materials, the unequal wear will in many cases condemn them, especially with such care and repair as they are likely to receive. There is an abundance of good surfacing material in the State, though it will require in most cases railroad or water transportation. In California the State is supplying excellent material fully prepared and delivered on board cars at 25 cents per ton, which is understood to pay the expenses of the maintenance of the convicts employed, and the railroads of the State are carrying that material at the bare cost of haulage, contributing thereby the free use of their tracks and their administration, so that this superior material is delivered to the counties at a price below the ordinary cost of inferior local materials prepared by free labor.

New York should, in justice, furnish that material free, under proper restrictions, and thereby contribute more effectually and equitably to the State's quota of assistance.

If a State highway commission is established, that body will be in position to make like terms with the railroad companies of New York State, which are naturally interested as much as the railways of California in the general improvement of the common roads; and by cooperation with the State prison commission it will be able to establish suitable points for the location of quarry camps for the preparation of road material. The entire disposable force of convicts could very soon be put to work in this direction, and this would dispose of the convict-labor question as well as the road question. It would also greatly improve the condition of the convicts. The superintendent of the Snake Hill prison of New Jersey found his hospitals nearly emptied when his quarry was opened and labor in the open air provided for his prisoners.

COST OF ROADS.

In conclusion, gentlemen, I wish to disabuse your minds of any false impression regarding the necessary cost of road improvement in this State. You need not be thinking of \$5,000, or \$3,000, or even \$2,000 per mile for country roads. Some of the very best roads in the United States are now being built for \$1,000 per mile, and except in the neighborhood of very large towns or cities that price will be quite sufficient to calculate upon for the State of New York, and if proper State aid is given and wisely applied through your State highway commission the share of this cost to be paid by local property will not be a burden. It may be contributed entirely in labor, as it is being done in some other places, and will amount to no more than the doing in one year of three or four years' ordinary road work, to be followed immediately by

a reduction of the ordinary road tax, since the roads, if well built, will need little or no repair for several years.

The county's share of the cost, if any large amount of road building is to be done, can be borrowed on long time at a low rate of interest, thereby carrying a portion of the cost of the roads, together with their benefits, down to the generations which will inherit them. The fraction of the State's contribution which will fall upon the farmers is so small that it may be entirely disregarded. Even with the full tax proposed by this bill, the amount paid by an average 100-acre farm assessed at \$2,500 would be only 25 cents per annum.

It is therefore no hopeless or impossible task for you to attempt; no grievous burden to be placed upon the people you represent, but simply the crystallization of a little sound business sense into legislation entirely for their benefit, and the greatest benefit that legislation can ever confer upon them.

Remarks at the Good Roads Banquet of the League of American Wheelmen,
Albany, N. Y., February 11, 1897.

GENTLEMEN: There is no need to preach good roads to the wheelmen. Every wheelman is a preacher, a worker, and a fighter for good roads. It is only necessary to furnish him texts for preaching, tools to work with, and weapons to fight with, and then to hold him back when his zeal outruns his discretion. It is mainly upon that line that I would say a word to you this evening. I know well how the wheelmen can fight for good legislation. In my first experience, five years ago, with the help of the League of American Wheelmen, under the guidance of President Burdett and the active and able leadership of ex-President Dunn, and when the league had less than half its present strength, I found how potent an agency it could be made; our bill for a national highway commission was pushed through the Senate of the United States almost entirely by the wheelmen's aid, and only failed in the House of Representatives through the determination of one man who had it in his power to put his foot upon it, and he was one who came from a district where the roads were so bad that he had scarcely a wheelman for a constituent. In that contest the most grave and reverend seniors of the Senate were startled by the enthusiasm of their constituents for good roads, as shown by floods of telegrams and columns of editorials, all of which I happened to know were inspired by our friends of the wheel.

Failing in getting a national highway commission, we organized a National League for Good Roads, and when this organization had been carried on for a year or more Congress took up its work and organized the United States Road Inquiry. We are ready through that office to furnish facts and arguments showing why good roads are necessary,

how they can be built, and how they are being built in many parts of this great country. We have a whole arsenal of weapons now at your service.

WHEELMEN AND THE FARMERS.

But in using these and all other weapons, I would beg you to remember that you are fighting and working not for glory and trophies, but for practical results in the line of good legislation and good roads. Your endeavor should be to conciliate the farmers while you keep the cities ripe for reform. You do not want to lose friends or to make enemies. You might succeed in passing good-roads laws in spite of the farmer, but you would have to depend upon the farmers at last for the execution of those laws. You must remember, moreover, that while you have been the active agitators for road improvement and have swayed public sentiment in this direction, the farmers have in some cases taken up the practical work of road building and carried it on with marked success. It was the farmers who originated the State-aid law of New Jersey and who have carried it into execution, with its vastly beneficial results, not only in that State, but as an example to many other States. And it was the farmers who built the Canandaigua roads in this State, at their own cost, by direct taxation, and who petitioned the legislature to increase the legal limit of their own taxation. Your effort, then, should be to keep the farmers with you, or, if possible, put them in the lead and yourselves in their support.

I am very glad to know that such a combination of effort is being made successfully in several quarters of the United States. Only a few months ago Mr. Potter, on behalf of the wheelmen, and Mr. Harrison and myself, on behalf of the Department of Agriculture, met the representatives of the New York State Grange in a most agreeable and satisfactory conference upon the subject; and wherever I have reported the result of this conference, it has been received with enthusiasm both by the farmers and by the wheelmen. In your discussion with the farmers and their representatives, you can bring to bear this powerful argument: That it is time to do away with the cruel injustice which places upon them and upon the small fraction of the property in the State which they hold the entire burden of building highways for the whole people. In the State of New York this burden is borne by less than one-tenth of the property of the State; and every measure which the wheelmen are advocating is in the direction of actually lifting this burden off the farmers' shoulders, instead of saddling a heavier one upon them.

In your argument with the men of the cities and towns you can show that of the burden of the bad-roads tax, which is infinitely greater than the tax for road building and repair, not less, in fact, by a consensus of many estimates, than \$600,000,000 annually, the cities and towns are bearing their full share; that, in fact, it would be impossible for the farmers to bear this burden, since it would quickly bankrupt the whole

farming community, and that they throw it over upon their customers, so far as possible, by increasing the price of their commodities. If you can impress these facts upon the people of the cities and towns and make them anxious to get rid of the bad-roads tax, and to help do justice to the farmers by relieving them of an unjust road-building tax, you ought to and must by so doing establish the most fraternal relations with the farmers' organizations of the country. And when the wheelmen's league and all the farmers' associations pull together harmoniously in this direction, working only for justice and the public welfare, there is no limit to the power they may exercise and the good they may accomplish.

Prosperity for the whole country will date from the happy hour in which that beneficent combination is established.

GOOD ROADS BRING GOOD TIMES.

That good roads will bring prosperity is no idle dream.

Through all the panic and depression of the last three years the farmers in the few good-roads districts of the country have gone on making money and improving their farms, and they have not troubled themselves much about politics or finance.

It is enforced idleness that makes farmers poor, and no farmer need be idle a day on account of bad weather or wet fields if only his roads are good. On a good road there is always paying work of some kind, and wet weather is just the time to go on the road. The French farmer never loses a good day in his fields, for he can do all his marketing in rainy times.

What prosperity would burst upon the country if every farmer and farmer's boy not at school and every farm hand and team could earn a full day's wages every day in the year, rain or shine.

PRACTICAL MEASURES.

When you have convinced your neighbors in the cities, and especially those of them who are candidates for public life, that the interests of the city population demand that they shall come to the relief of the farmers, you can go to the farmers with this assurance of help and ask them to take into careful consideration the practical measures by which this relief can be brought about, and especially the measures for providing State aid and for the use of convict labor.

It is only through State and county aid that the cities and villages can help. If you find the farmers clinging to the old ways, say to them that these ways are mainly an unfortunate inheritance from the mother country, which we brought away with us and failed to shake off when the system was abandoned there, and that to-day in Great Britain not only are the roads maintained at the general cost of the people, but Government loans are made for any specially heavy improvements that are desired. Two hundred years ago the great highways of that country

were kept up, so far as they were kept at all, just as they are in this State to-day—by local taxation, while they actually served the people of the whole Kingdom.

CONVICT LABOR.

Upon the convict labor question let them understand that a thousand idle men are being marched about in Sing Sing prison to-day for exercise whose labor, if properly directed, could provide the material for thousands of miles of good road every year, and that the honest industry of the country pays for maintaining these criminals in idleness.

These things would be incredible if told in England to-day. They would be a bitter reproach to our republican institutions; and they would add another argument, and a most powerful one, for those who claim that our system of Government can not care for the economic interests of the people as well as a monarchy. It would be a fatal indictment against our institutions if it must be truly said that a free people in a rich country can not secure for themselves the blessings of good roads.

ROAD LEGISLATION IN NEW YORK.

Although this occasion is national in its character, probably the majority of those present are citizens of the Empire State, and I may be pardoned for saying a word upon legislation for good roads in New York.

The direct money loss by bad roads in this State is now about \$30,000,000 annually; and this is no guesswork, but the result of careful investigation and computation. This loss is wholly chargeable to bad government, and the remedy for it ought to be the first concern of the lawmakers of the State. No other interest of the people, nor all their material interests that are subjects of legislation, compare with it in magnitude or in pressing importance.

And the remedy is plain and easy; no further study of the subject is needed and no experiment is required. It is only necessary to follow in the footsteps of other States. If the State-aid bill which passed the assembly by four to one three years ago had become a law, this State would have been to-day in the front rank of road reform, with object-lesson roads scattered all over the State; and other States would have been following in our footsteps. It is not too late yet, but it is high time that the Empire State was moving. Massachusetts has set a pace which New York can hardly keep, but the example of New Jersey and California is quite sufficient, and if the best available intelligence of this State can be set to work to apply their example and adapt their experience to the conditions that exist here, it need not be long till New York is abreast of the leaders in the race.

Taking New Jersey for a pattern in State aid and California for the use of convicts in preparing road materials, we have all the legislation that is needed.

In California the best of road material is furnished for 25 cents per ton prepared and put on cars, and this pays for maintenance of convicts, while the railways carry it for another 25 cents per ton, and the counties get this material for less than the cost of inferior local materials.

Put your idle prisoners at this work in this State and you have solved the convict-labor question as well as the road question.

Address at Raleigh, N. C., February 5, 1897.

MR. PRESIDENT AND GENTLEMEN OF THE GENERAL ASSEMBLY OF NORTH CAROLINA: When I had the privilege of speaking in this chamber before on the subject of road improvement it was only by the invitation of a few public-spirited citizens. I speak to-night at the joint request of the senate and house of representatives of North Carolina, and I take this fact as a happy augury of the progress and success of the movement for good roads throughout the United States.

It is an honor for any citizen of the United States, or any official of the Government, to be invited by joint resolution of your honorable bodies to address them, and especially upon so important a subject as the improvement of highways. To me it means more than honor and more than personal pleasure. It adds another proof to the many I have received that the work I have attempted personally and the work I have been instrumental in shaping for the General Government in behalf of road improvement in the country is acceptable to the people and the governments of the States of this Union.

It was a critical moment in the great campaign for road improvement when the National League for Good Roads accepted the help of Congress to carry on its work, and thereby risked a plunge into the sea of politics. The league had been carried on successfully for a year by private subscription, and \$10,000 in cash had been expended in its campaign. It could only receive the help of the Government by being made a Government bureau. I had been solemnly warned before we organized the national league that we were treading on dangerous ground when we succeeded in securing the passage of a bill through the United States Senate establishing a National Highway Commission of Inquiry, and a statesman for whose knowledge and abilities I had the highest respect, and whose word was law at the moment, put his foot upon that legislation in the House of Representatives, with the declaration that the roads of a State were the private concern of its own people, into which the General Government had no right to inquire. With this warning it was delicate work to inaugurate a Government inquiry, and if that work has gone on slowly, it has been because of its very delicacy. To have aroused the old antagonisms and stirred up the old questions of State and Federal jurisdiction by any ill-advised and hasty proceeding in this direction would have been fatal to all hope of good results from the inquiry.

By quiet and steady effort, however, and with the cooperation of good citizens in every State, such cordial relations have been established between the United States inquiry and the State governments that its work has never been criticised by the most earnest advocate of States' rights; on the contrary, it has been welcomed and aided by State authorities everywhere.

The State of North Carolina has already made such progress in some sections in the improvement of its highways that wherever I have gone I have been able to hold the Old North State up as an example and incentive—a shining beacon light—to States of far greater wealth and population. I am sure, however, that the little taste you have had of the fruits of road improvement has only given you an appetite for more, and that you are anxious for more speedy progress if the way can be found without oppressive taxation or dangerous indebtedness.

THE TAX OF BAD ROADS.

In considering the subject of taxation for good roads you must take into account the tax of bad roads, and one of the most thorough and valuable studies made by the Office of Inquiry has been in this direction; in this study we have done nothing but collect actual facts and information from farmers themselves, and apply that information to the other facts collected by the Census Bureau. We have consulted 10,000 of the most intelligent farmers in the United States, located in every agricultural county, as to the present actual cost of marketing farm products, and we find the average to be almost exactly 25 cents per ton for every mile those products are hauled. This is three times as great as the cost of hauling the same products over good roads, as testified again by farmers in the good-road districts in this country, and it is four times as great as the cost of hauling over the best roads in foreign countries. Taking the total amount of farm products in the country, together with the necessary hauling of farm supplies and other materials over the country roads, we find that the total cost of the hauling done on those roads is not less than \$900,000,000 annually. Taking into account also the loss sustained by reason of the failure to reach market with perishable articles, the failure to cultivate products which would be marketable if markets were always accessible, together with the enforced idleness of farmers and draft animals through periods of wet weather, we deem it entirely safe to say that \$600,000,000 of this \$900,000,000 can be saved to the country when good roads become universal. This \$600,000,000, then, is the annual bad-road tax. And, again referring to the census returns, we find that this is equal to one-fourth of the home value of all the farm products of the United States.

It is needless to say that this tax is not all borne by the farmers alone; it would promptly bankrupt the whole agricultural community. The farmers add all of it they can to the price of their products and thus saddle it upon the merchant and the consumer, and this it is which is

making the people of cities and villages and of all other occupations than farming willing now to help bear the burden of road improvement. The Chamber of Commerce of the city of New York says: "We are handicapped in all the markets of the world by an enormous waste of labor in the primary transportation of our products and manufactures."

BROADER CONSIDERATIONS.

Other and broader considerations are involved in this question. Self-government by a great people is on trial with us here, and many doubts are expressed whether the economic interests of the people can be guarded as well by a republic as by a monarchy, and the world will watch and is watching to see whether we can throw off this burden. It will be a fatal indictment against our institutions if a free people in a country rich in resources can not hope to have the blessings of good roads.

AN INHERITANCE.

Our condition in this respect is an unfortunate inheritance from the mother country. We stand where England did two hundred years ago, and the system which was abandoned soon after that time there still clings to us. Macaulay deplores the injustice which made the maintenance of the highways a local charge upon the people of the country districts. That injustice still prevails with us.

In the State of New York the farmers only own one-fourteenth of the property of the State, and that fraction is charged with the whole cost of the maintenance of the highways for all the people of the State.

SPECIAL INDUCEMENTS IN NORTH CAROLINA.

Your State has many special considerations which should prompt it to a speedy effort, even at some sacrifice, to improve the roads. I have lately urged upon the people of Maine to make good roads for their summer visitors, and upon the people of Florida to do the same for their winter visitors. Midway between these localities are your mountains—a summer resort for the South and a winter resort for the North and a health resort for both all the year round. You offer there all attractions but the one essential feature, the means of easy and comfortable access and communication.

If your mountains belonged to a wide-awake syndicate, that syndicate would spend millions of dollars on its roads, and this regardless of all considerations but one, the entertainment of tourists.

AGRICULTURE.

Your statesmen and scientists and your practical business men, whether farmers or merchants or manufacturers, are constantly studying how to benefit the agriculture of this State. Those who have

traveled in France are convinced that no lasting prosperity can come to any people without good roads. Our farmers are often charged with idleness and waste of time, but you must admit that it is no fault of their own—the condition of their highways is almost entirely responsible. The French farmer loses no time by bad weather, bad roads, or wet fields. Wet weather is his time to go on the roads; with covering for his load and his horse and himself, he takes the opportunity of a long rain for a long journey with a big load. If he has no loading of his own he hauls for a neighbor, or goes off a long distance for some cheap fertilizer to enrich his land.

You are all studying further how to renovate the worn-out soils of the lower portion of the State; how easy this would be if you had good roads, and such cheap fertilizers as lime, marl, muck, leaf mold, and the refuse of the towns could be hauled, as is done in the neighborhood of Philadelphia, in loads of 3 or 4 tons to a pair of horses. It is not uncommon there to see cheap fertilizers hauled 20 miles on a wagon.

PRACTICAL REMEDIES.

Gentlemen of the assembly, I am not prepared to recommend any definite measures of legislation to you to remedy all this difficulty at once. It would require a long study of the conditions prevailing in your State. It is a study which can not even be made thoroughly by legislative committees during the labors of the session of the legislature. I doubt if you are prepared for such thorough measures as have been taken by some of the States, but at least you are prepared to adopt the same measures as those States which have chosen to ascertain what can be done under conditions like yours. You have men enough in the State, perhaps men enough already in the State employ, who are competent to investigate this subject and lay before the legislature definite plans for road improvement. They will need to study all the methods of other States and the local conditions of all parts of your own State. The difficult problem of road improvement is actually being solved in many parts of the United States to-day, and it only remains for you to choose the best of the various methods.

RAILROADS.

In any general system of first-class road building a great amount of railroad transportation for road materials will be required. If you will place this investigation in the hands of a suitable body of representatives of the State government or citizenship, and indicate that the State is ready now to commence a substantial system of road improvement, I am sure the railroads of the State may be depended upon as one of the most valuable contributing features to that result. We have corresponded with nearly all the leading railroad men of the country, and we find the disposition to assist in this matter almost universal. Even in California, where the railroads are all in one strong hand, and that

hand accused of hostility to the interest of the people of the State, effective cooperation has been established between the State and the railways. The State has undertaken the preparation of road material by means of its convict labor, and the railroads have agreed to transport that material at the bare cost of haulage, practically giving the free use of their tracks, their plant, and their administration, with the result that the broad valleys of that State which have no road materials are able to build roads, paying to the State the actual cost of the material, including the maintenance of the prison and convicts, and to build those roads at a vastly less cost per mile than is common in places having abundant road material on the spot to be prepared by free labor. This fact carries its own suggestion to all the other States, especially to those where difficulty is found in obtaining suitable labor for the State prison convicts.

Letter to Illinois Farmers' Institute.

GENTLEMEN: I have been endeavoring to arrange matters so that I might be with you on the 25th, and to that end have tried to make some other Western appointments to share the expense of the journey; but I have failed in this, and now I am summoned on the same day to attend the final joint hearing by the committees of both houses at Albany on the New York State-aid road bill. This bill is one which I have aided in framing and have promised to help put through. I am especially interested in it, as it is the most liberal of all State-aid measures except that of Massachusetts, and its passage at this time will be of great service to the work in other States.

New York and Illinois are similarly conditioned as to city and country population, and as the main object everywhere now is to bring the cities to the aid of the country in building roads, perhaps I can serve you as well at Albany as at Springfield.

The New York bill proposes State aid of 50 per cent and county of 35, leaving only 15 per cent for the local charge.

I have sent you already a quantity of our latest publications for distribution among those present.

Observing your request to "bring the subject as near home to the Illinois farmer as you can by suggestions that would be peculiarly applicable to Illinois roads," I am quite aware, as you say, of the fact that "conditions of the soil and material for the construction of permanent highways differ from those in most other States," and that "there is a deep-seated prejudice in the minds of a great many farmers against legislation looking toward improved highways on account of the great expense which they believe will fall upon them."

Comparing Illinois, however, with many other States, I see nothing

hopeless or seriously difficult in your situation, and if you will prepare to avail yourselves thoroughly, and with the best intelligence your people can command, of the successful experience of other States, you will find nothing in the way of making as rapid progress in road improvement as any of them.

In the first place, you have generally no hills to cut down, and you have the best of natural roads in dry weather or when the roads are frozen and smooth, and you have only to provide narrow tracks of stone or other hard material for use in wet weather in order that your perfect earth roads may not be traveled and spoiled when they are soft. You have already learned the importance of keeping the water off the roads by surface drainage and of the occasional use of under-drains. Your principal roads are generally raised to a sufficient crown, and all you need, therefore, is the hardening of a single track through the center or one side of those roads for wet-weather travel.

The use of single-track stone roads is becoming so general and is found so satisfactory that you will run no risk in adopting that system for ordinary country roads. It saves, in the first place, one-half the cost of macadamizing, and in the second place it saves much more than one-half of the wear and repair of the macadam road, since that road is only used for a portion of the year, and that portion is the wet season, when it wears to the best advantage.

The anticipated difficulty in passing teams has not been found at all serious. The reduction in width of macadam for country roads to 8 feet and the reduction in depth to 6 inches, which also has been found entirely satisfactory, reduces the amount of material required for macadamizing to 800 cubic yards per mile.

Whenever such arrangements can be made in your State for the production and distribution of this material as are now being made in other States, and when, moreover, the cost of your road building shall be properly shared by all the property in the State, your farmers will find that good roads all the year round are entirely within their reach and they will be eager to possess them.

In California the hardest trap rock is being quarried and crushed by the State-prison convicts and furnished to the counties fully prepared for use and delivered on board cars at about 28 cents per cubic yard, and this is understood to cover the entire cost of maintenance of the prisoners and pay a small profit to the State.

Your State can well afford to give the use of its convicts for this purpose, making their maintenance a contribution on the part of the State to road improvement, and that contribution will of course be one in which all the property of the State would share. In that respect it is twice as equitable as the 50 per cent State contribution proposed in New York State.

The railroads of California carry this road material at the bare cost of haulage. Your railroads would undoubtedly do the same if the

State should enter upon a general scheme for rapid road improvement, and their cost of haulage is much lower than that in California, where fuel for locomotives has to be imported.

As to material for roads, you have gravel and limestone in the north end of the State and quarries of quartz in the south, while your great drainage canal has thrown up a mountain range of broken stone for a length of 25 miles sufficient and suitable, with perhaps something better for surfacing material, to macadamize all the roads in the northern half of the State.

Suppose the State to furnish this material free and the railroads to transport it at cost, and to do that by advancing their own local taxes for a term of years, as the Illinois Central has done in some cases, and then suppose the farmers to haul this material from the railroads by voluntary contribution of labor, as they are doing in some parts of New Jersey and elsewhere, the whole problem is solved, practically without any expenditure in money on the part of the farmers, and even their ordinary road taxes may be at once reduced, as they have been in some of the districts of New Jersey where permanent roads have been constructed.

To accomplish this broad scheme of cooperation, however, needs, as I have said, the application of the best intelligence at your command. A general highway commission composed of the leading officials of the State and representing its full sovereignty, together with representatives of the agricultural interests and of the good-roads movement, could deal with the whole subject with the weight and authority which its importance demands. Such a commission would promptly avail itself of a knowledge of the experiences of other States and of the conditions in your own State. It would command the attention and cooperation of your railroad companies and the confidence of the people; and even if it did not find this scheme immediately feasible, it would probably develop some other which would put you on the way to good roads. It is in this direction that other States are moving to inaugurate road improvement. Those States which have not already permanent working highway commissions are establishing commissions of inquiry such as I have ventured to propose for your State, and several States are moving for amendments to their constitutions to permit State-aid legislation. It would seem desirable, as your legislature meets only biennially, that authority be given to a commission not merely to make inquiry, but to actually make a beginning upon the lines indicated, in order that the next legislature may see something of the practical working of such a system. This is, however, a question for the legislature to decide; but it would be unfortunate if you should lose another two years without at least a competent inquiry into this important subject.

Your share of the loss by bad roads is certainly not less than the proportion of your population to that of the whole Union, and a loss

of two years' time means a loss of at least \$50,000,000 to your State in the postponement of road improvement.

I will ask you to send me the published accounts of your meeting and your full proceedings when they are printed, and I shall be very glad if this office can be of any service in furnishing information to the committees who may take up this matter in the legislature.

I am very glad the institute is taking up this subject, and trust it will bring all the weight of the agricultural interest into the scale for road reform, in which case it can not be long delayed.

Very respectfully,

ROY STONE,
Director.

MESSRS. CHARLES F. MILLS, D. W. SMITH,
and A. A. BILLINGSLEY,
Illinois Farmers' Institute, Springfield.

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United States Department of Agriculture,

OFFICE OF ROAD INQUIRY

WASHINGTON, D. C., *March 13, 1897.*

SIR: I have the honor to transmit herewith a paper on *The Forces Operating to Destroy Roads*, which is very generously contributed by the author to the literature of this office. It will be useful to all who are studying the subject of road construction from a scientific as well as a practical point of view, and I recommend its publication as Circular No. 29 of this office.

Very respectfully,

ROY STONE, *Director.*

Hon. JAMES WILSON,
Secretary of Agriculture.

THE FORCES WHICH OPERATE TO DESTROY ROADS, WITH NOTES ON ROAD STONES AND PROBLEMS THEREWITH CONNECTED.

By C. L. WHITTLE.

Other things being equal, the endurance of a roadbed depends upon the qualities of the stone used, assuming the road to be properly constructed and adequately drained. A road is subject to attack and consequent loss of material in part by reason of the composition of the road metal of which it is composed. The means of attack brought to bear upon the surface of a road, in the order of their importance, are physical, dynamical, and chemical.

The *physical* agencies are (1) the disrupting effects of frost, both on the integrity of the roadbed as a whole and on the individual rock fragments and minerals; (2) the transporting power of water in gully-ing the road, in washing particles of sand and clay to the side drains and ditches, and the sorting action of water whereby the winds are given better access to the finer and lighter parts of the products of road wear; (3) the transporting power of the winds; (4) the attrition and weakening effect of falling rain; (5) gravity.

The *dynamical* agencies are (1) friction, which results from the grinding action of one fragment of rock against another under the action of carriage tires and the feet of animals; (2) the impact resulting from the same causes; (3) the disrupting effect of roots.

The *chemical* agencies are (1) decomposition, shown, for example, by

the disintegration of the feldspar-bearing rocks whereby the feldspars and other minerals are converted into clay, quartz, calcite, etc.; (2) solution, or the power possessed by surface waters impregnated with acids to dissolve most rocks and the products of decomposition of others and carry them away.

PHYSICAL AGENCIES.

It has been the object of the highway engineer ever since the days of Macadam to construct a road in such a manner that frost action above subgrade may be reduced to a minimum. Macadam contended strenuously for a dry foundation. The evils resulting from the disrupting effects of water alternately freezing and thawing in the foundation of a road are too apparent and too well known to warrant a restatement. There is no one principle of greater importance than this, and to-day engineers differ only as to the best means necessary to attain such an end. Frost action is not only a potent factor in disrupting a road as a whole, but its presence in stones is promotive of weakness and more rapid crumbling. The presence of frost in fragments of broken stone operates to increase their brittleness to a considerable degree, and for this reason gives rise to a more rapid disintegration of the screenings and the upper portion of the road. So pernicious is this agent in causing brittleness that quarrymen, where blasting is necessary, so time their work as to avoid blasting operations during the winter.

The ability of water as a medium of transportation of material by a mechanical process depends upon the specific gravity, the size and the form of the fragments, and upon the velocity of the water, or, what amounts to the same thing, the slope of the roadbed. The ratio of rise to horizontal distance is largely a matter of custom, but a 5 per cent grade is now considered about the limit of steepness. It is not always possible to obtain without great expense a grade of 5 feet in 100 in some parts of our country, but the necessities of steeper grades are not frequent in the Eastern half of the United States, although the old custom in New England of building over rather than around the hills often makes the roads of this region excessively steep. The gulying of roadbeds during heavy rains or melting snows is the most conspicuous work done by flowing water on our ways, yet we should not pass by the sorting process it exercises even on gentle slopes, where the grains of the least weight and specific gravity and of the most tabular form are made to occupy the surface of the road, thus, after drying, falling an easy prey to the power of the wind. This sorting action arises from the fact that, other things being equal, the sand grains will arrange themselves in water in the order of their specific gravities, the heaviest at the bottom. An exception to this rule is found when minerals even of a high specific gravity are characteristically of a tabular form, since the resistance they offer to descent, owing to their relatively large surfaces, causes them to arrange themselves at the top with minerals of the lowest density.

The slow-working water during ordinary rain storms, as it flows toward the gutters, carries in its grasp the finer grains of quartz and feldspar resulting from the wear and tear of a roadway of granite macadam. The mica usually present in granites is very easily transported both by wind and water action, owing to its tabular character, and this mineral under all circumstances is undesirable in road metals. When the necessities of the case force the use of granitic rocks it is well to select those, such as syenites or granites, containing as small a percentage of mica and quartz as possible. When accessible, the chemical analysis of the rock will usually be a safe guide in this latter particular, those having the lowest amount of silica being the freest as a rule from quartz. In case a granite is in an extreme state of decomposition it should never be used for the superstructure of a road, as the great amount of clay present, and resulting from further decay, gives rise to sticky roads in wet weather and dusty ways in dry periods.

Experiment has shown that even among the diabases and diorites there are great differences in the essential properties on which the quality of a road (both the character of its surface and its power of resisting wear) depend. There are important differences of mineral composition as well as coarseness of texture, and experiment has shown that within certain limits the coarser the grain the weaker the crushing strength of the stone. It is to be expected that diabases, which vary in grain while they remain constant in mineralogical composition, would decrease in crushing strength and coefficient of abrasion with an increase in coarseness of texture.

A careful study of the wear and tear of a roadbed shows that the combined operation of wind and water play no inconsiderable part in the destruction of the way. Considered from the point of view of wind action alone, it will be seen that the ability of wind to take up and bear away grains of any rock will depend upon several factors.

These in the order of their importance are: (1) The form of the particles subjected to the wind's influence; (2) the specific gravity and size of the individual grains; and (3) their accessibility to the action of the wind. The form of the grains will depend upon their original shape in the rock and that which they may be induced to take as an effect of road wear, or as a result of chemical change. Some diabases carry an essential and considerable percentage of black mica, which, owing to its tabular form and the readiness with which it cleaves into thin plates, is quickly and easily transported by the winds. Other minerals possessing a less perfect cleavage would not be removed so rapidly from the road. The mineral feldspar, as it decomposes to clay, furnishes abundant material for the wind's work, and so, too, rocks like slates and limestones, which readily crumble to a fine dust, suffer a great loss from this cause. Wind-blown material is not only objectionable, since it increases the cost of road maintenance, but it is an intolerable nuisance in connection with our macadamized roads. It furnishes one of the

most conspicuous grounds of criticism upon which people who antagonize the modern road are not slow to seize.

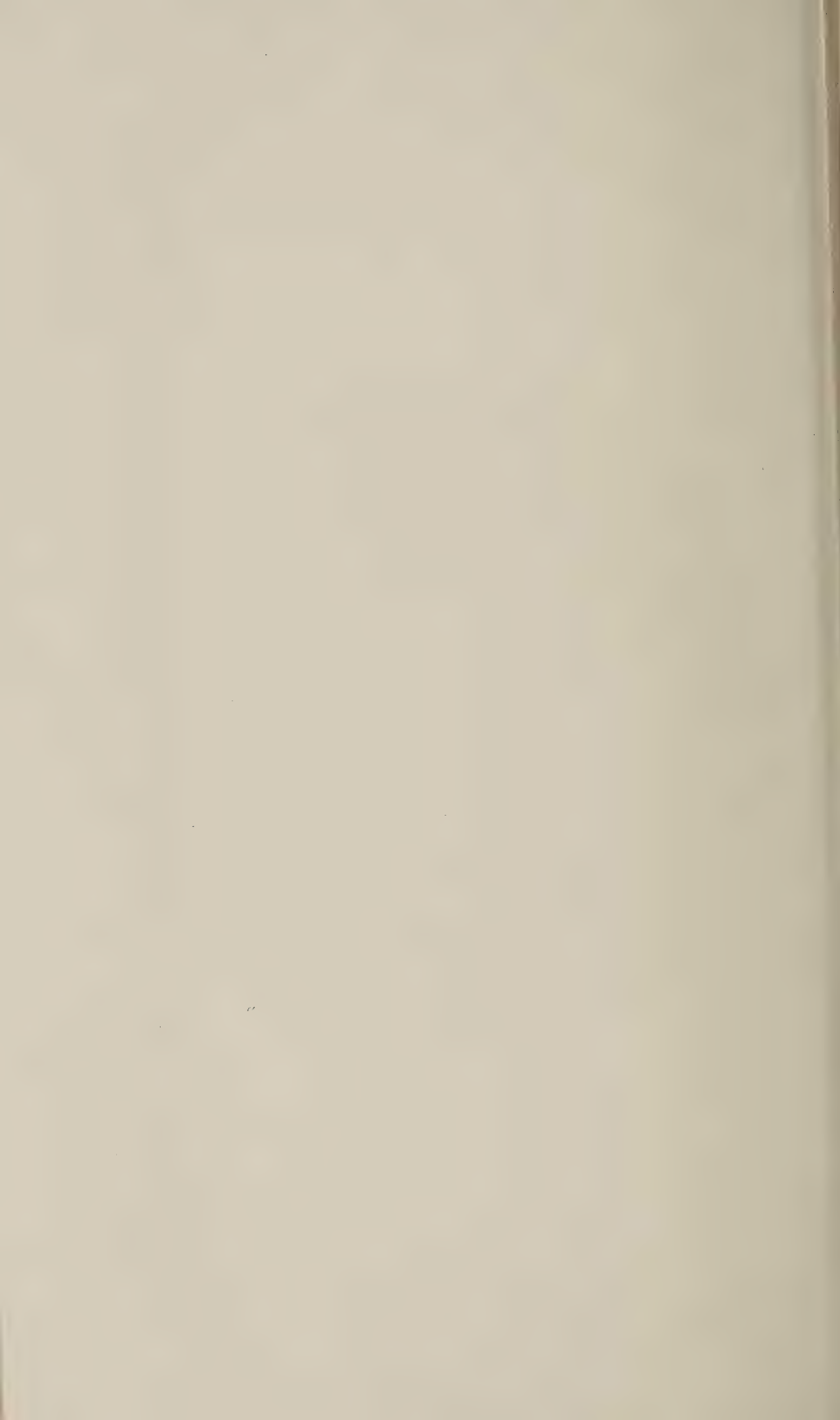
The specific gravity of individual minerals and the rock as a whole are of importance when we come to consider the surface of the road, for the crushing effect of traffic is often sufficiently great to separate the different mineral grains from one another. Under these circumstances the sorting action of the wind will tend to remove the minerals having the least specific gravity, and this will be particularly true when the grains possessing the least density happen to coincide with those of a brittle nature, which for this reason are most liable to be ground to a condition of fine dust under the action of the wheels. The rain falling upon the road serves to concentrate the minerals into layers in the order of their specific gravity. This will not be found true of the micas, for these will be found concentrated near the surface with the minerals of a less density and both made accessible to the action of the wind. In the case of most roads it is undoubtedly true that the greatest loss sustained from any cause arises from the transporting power of air in motion; and the road architect will do well to bear in mind that there are other considerations in selecting suitable road metal besides resistance to abrasion and cementing qualities, important as these properties are. The most suitable stone then to be used on our highways, to withstand the action of the wind, is one whose products of abrasion are of a high but uniform specific gravity, and which is free from all minerals that by their tabular form are prone to be thus transported. Were it not for the objectionable character of wind-blown material it would be very desirable that the greater part of the products of road wear be thus removed, but excessive wind action not only allows the fragments of broken stone to come into immediate contact with the wheels but it takes away the cementing material between the surface fragments to an extent which can not but affect the road injuriously.

A small amount of dust is of value on a road, acting like a cushion to protect the broken stone from the action of the wheels and the animal's feet. The value of this dust film is further enhanced by a small quantity of moisture.

Although relatively unimportant, we should not pass over the injury done by the impact of falling rain water in causing a certain amount of attrition and loosening of those grains which it is able to move about, and a certain weakening of the coherency of the surface as far down as the water is able to penetrate. Reference will be made to the probable value of a small amount of surface water in serving to prevent loss by wind and its action in making the road impervious to percolating waters. Capillarity plays an important part in tending to produce a firmer surface after the manner particles of sand are held together by thin films of water between the different grains. Gravity also plays its part as seen by the work done by running water and falling rain, but through its



DIORITE, SHOWING INTERLOCKED STRUCTURE.



operation alone there is always a tendency exercised for grains and fragments of rock to work down the slopes toward the sides of the road. Under some circumstances the effect of gravity may completely destroy a roadbed. When the way is constructed along a mountain side whose soil is slowly creeping toward the valley, the cut made necessary for the road is often sufficient to so weaken the hold of the soil as to precipitate the surface of the country down the slope as a landslide. Roads may also be destroyed by avalanches of trees and stones from a point farther up the slope.

A roadbed may suffer disruption by shrinkage of the subgrade. It has been determined experimentally that clay shrinks one-fifth of its bulk in excessively dry weather and increases to a corresponding degree when wet, and that silicious sands and gravels undergo no change in volume. From this it follows that when a way passes over a clay bed, which may become dessicated, injurious results are likely to follow, particularly at a point where the clay abuts a sand substratum which is unaffected by weather changes.

DYNAMICAL AGENCIES.

The gradual destruction of a roadbed by the ordinary processes of friction and impact is always to be expected, and the rate of wear would seem to depend directly upon the hardness of the road stone used in its construction, and yet so many factors have to be taken into consideration in choosing a road metal that it is found that the question of hardness, important as it may be when combined with other qualities, singly is not of greatest consequence. Quartz, the hardest of our common minerals, used alone does not make a desirable road stone, as its dust is lacking in cementing power; it has a low specific gravity and is very brittle, qualities we should seek to avoid in selecting a road material. On the other hand, rocks as soft as limestones and slates are quickly ground to powder and are rapidly carried away by water and wind action. Hardness is of importance in tending to resist the abrasive effect of wheels and the feet of animals, but brittleness promotes crumbling under the impact of blows thereby delivered.

When the way passes through woods or when large trees occur along the roadside, the integrity of the foundation may be disturbed by the force of growing roots. In this connection it will be well for those having charge of beautifying our thoroughfares to plant trees, the roots of which lead downward rather than horizontally.

CHEMICAL AGENCIES.

With some exceptions the great majority of our rocks used in road construction all over the United States contain a considerable proportion of the mineral feldspar. The important exceptions to this rule are the limestones, or marbles, slates, quartzites, including vein quartz and chert. The two most important rocks (considered not from the point of

most common use but from real merit) have a very large percentage of this mineral, while of granite and gneiss, also largely used, the same thing is true. The relative value of these rocks and the reasons therefor will be considered later. We have now only to do with the chemical agencies which accomplish their disintegration.

In diabases and diorites the feldspars are essentially aluminosilicates of calcium and sodium, and they form one of the unstable compounds, under the influences of their environment, on which depends so largely the rapid disintegration of these rocks. When these rocks (which are commonly called "traps" or "dike stones") are used in road construction, and are fresh, little loss from this cause is to be apprehended during the life of a road, but where the weathered portion of the rock, the sap, is used the loss sustained by chemical and mechanical means is considerable. The alteration of feldspar to clay, quartz, and calcite so weakens the coherency of the rocks that they readily crumble to powder under pressure, and are converted into fine sand. Wind quickly transports the fine quartz and clay thus liberated from the surface of the road, and rain water charged with organic acids derived from decaying vegetation rapidly dissolves the calcite and carries it away. Near cities we must add to the organic acids those derived from gas plants and manufacturing establishments, which are powerful agents and attack not only calcite but other minerals as well. These acids are largely nitric, sulphuric, and hydrochloric.

The organic acids occurring in all water circulating through the soil in fertile regions are carbonic, humic, ulmic, crenic, and apocrenic. Rain water impregnated with carbonic acid alone acts as a slow solvent on all the common minerals occurring in road stones, attacking even quartz, but a mixture of the various acids, organic and inorganic, acts more rapidly. The silicates are less soluble than most other minerals excepting quartz.

The essential mineral pyroxene and the occasional minerals pyrite and black mica in diabases are also prone to decomposition—a change which is aided by the presence of these acids. Diorites contain hornblende, of which the same thing may be said. Although there is considerable loss and injury sustained by road metal from chemical changes, they are relatively much less important than the part played by solution when a rock composed wholly or in part of calcite is used. A limestone, or marble, which is practically all made up of this mineral, suffers a very considerable loss from the fact that it is so readily soluble in rain water when impregnated with acids. It has been shown that rain water charged with carbonic acid will dissolve when cold one part of lime carbonate in 10,800 parts water. Where a limestone, or marble, has also present a high percentage of magnesium, as the mineral dolomite, the loss from this cause is somewhat less, but still important. If we add to the other objections to the use of limestones for road building the loss due to its solubility, we shall see that of all stones



DIABASE, SHOWING INTERLOCKED STRUCTURE.

adapted for road construction this stone is among the poorest. Although not well understood, it is probable that the chemical agencies present in the dung of animals are also of a nature to operate disadvantageously to a roadway.

ESSENTIAL QUALITIES OF ROAD STONES.

In going over the considerable body of literature on the subject of road metals already accessible, the highway engineer will find many statements regarding their utility which are at variance with one another. This unsatisfactory condition of things arises from the fact that some materials are stated as desirable when the tests to which they have been put have not been sufficiently severe; that the standards in different countries, and even in the same country, are of necessity not the same; and the conditions affecting the value of a road metal, as determined by climate and all that this implies, are not properly understood. A road stone that will well subserve the needs of a farming community in the South, where the element of frost does not need to be taken into consideration, would quickly go to pieces if subjected to the rigors of our northern winters. Granite in some localities is considered a very satisfactory stone; in other places it is adopted merely as a makeshift, while some authorities would discard it from the list of available road metals. This difference of opinion has probably arisen from the fact that different kinds and conditions of granite have been used under very varied circumstances. Whereas the weight of testimony places this rock among our less desirable stones, it certainly does not deserve to be discarded altogether.

A geological study of the rocks and all sources of supply of road-building materials in the United States shows that although the range in variety is very great the distribution of stones of the highest grade is not general. This fact is to be deplored, but it only serves to emphasize the importance of a proper appreciation of the value of the road metals at hand and the uses to which they may be put.

First and foremost in importance among our road stones is the class of rocks commonly called traps, or dike stones, and technically known as diabases and diorites. These rocks are not uniformly desirable, but nearly all of them are better than the best of other rocks. As of practical and educational value it is proposed to consider in what manner they differ from other rocks used in road building, and on what quality or qualities their superiority depends. An understanding of these qualities may, perhaps, best be had by comparing them with a rock of intermediate value as a road stone, and one which, by general agreement, is regarded as the poorest, granite and marble being taken as examples.

These three classes of rocks present a wide range in chemical and mineralogical composition, and a still greater variation in properties and internal structure. Upon these differences their behavior as road

metals are manifestly dependent. Before the microscope was introduced in the study of rocks only superficial differences could be detected. At the present time this instrument opens to our inspection the internal arrangements of their component minerals, and furnishes as well an accurate method for determining what these minerals are. The presence and amount of decomposition, a condition always found in our rocks to a greater or less extent, and the determination of the character of the chemical changes are among the elementary possibilities of this instrument, and it is largely by its use, and the facts gathered by experimental work in the laboratory, that we are able to arrive at a partial understanding of the factors on which the value of a stone depends as a road metal.

In practice the qualities which are commonly regarded as essential in a road stone are resistance to abrasion (which is largely determined by hardness and toughness), cementing, and recementing value. Attention has already been called to certain other properties that are also important, and these are freedom from attack of organic and inorganic acids. The dust resulting from abrasion should be of a nature best to resist the power of the wind, and this dust should be free from mica and be of as high a specific gravity as is possible in a stone possessing the above properties, in order that the effect of running water and wind may be reduced to a minimum. It is a matter of remark that nature has furnished in diorites and diabases rocks which possess nearly all of these properties, and it becomes of interest to find, if possible, an explanation of these facts by means of the microscope and by chemical analysis. We will consider these qualities in the above order, and point out in what rocks of the three classes chosen they are present, and suggest an explanation as afforded in great part by the microscope.

Normally a diabase is made up essentially of feldspar and pyroxene, with or without black mica, and diorite may be considered as the same rock with the mineral hornblende replacing the pyroxene. A true granite is composed of quartz, orthoclase feldspar, and two micas—biotite and muscovite. The micas are not always present, their place being wholly or in part taken by hornblende or pyroxene. Considered from the standpoint of mineral composition, the striking difference between these rocks lies in the fact that the two former do not possess quartz. There are, however, several other important distinctions aside from this and chemical composition, among which is an entire difference in the form and arrangement of their constituent minerals. By referring to the accompanying illustrations the reader will perceive how strikingly great is this disparity.¹

¹These plates were made by photographing the appearance of these rocks as magnified under a microscope. In order to obtain transparent rock sections a fragment of the stone is cut quite thin with a diamond saw and is then ground down by means of emery wheels to a thinness of one six-hundredths to one eight-hundredths of an inch. Under these circumstances all ordinary rocks are of sufficient transparency to permit the passage of light.



MARBLE, SHOWING GRANULAR STRUCTURE.

The effect of the structure of diorites and diabases, in which the minerals composing them are interlocked with one another in the most perfect manner (see Pls. I and II), is to produce rocks whose toughness is very great. To the effect of this structure must be added the great toughness of the mineral hornblende in diorite and the less toughness of pyroxene in diabase. In the granites the structure is granular with little tendency toward an interlocking arrangement. A part of the difference of the crushing strength of these two classes of rocks is to be explained in this manner. Rocks of the trap class have a recorded crushing strength of 29,000 pounds to the square inch, while a good granite does not as a rule possess a crushing strength of over 20,000 pounds. To this property of the traps, due to their structure, we must add the uniform hardness of the individual minerals, pyroxene and hornblende, which go to form so large a part of these rocks, a relationship which serves to prevent differential wear. Their hardness and that of the accompanying feldspar is the same—5 to 6. Resistance to abrasion depends upon the elements of hardness and toughness and the latter quality is found to predominate in the dike rocks.

In granite the place of pyroxene and hornblende is occupied by quartz, one of the hardest as well as most brittle minerals of common occurrence, and this fact offers a partial explanation of the greater brittleness of this rock. When a granite is free from mica it offers great resistance to wear, but its brittleness and its granular character operate to increase the rate of abrasion. As road metals they differ much in value—a variation caused by differences in mineral composition and grain, and in particular by their integrity as affected by the degree of weathering. No granite can be found whose feldspar is free from some secondary alteration to clay, and when this change has gone on to a degree sufficiently great to affect the strength of the stone it should be discarded as unfit for road metal. Granites in this condition quickly crumble to sand and clay, and the winds sweep away the fine material in dry weather, while in rainy times the road is in a muddy state. If mica be one of the constituents, it is swiftly transported by the winds, owing to its tabular character, or carried off by running water. The rock syenite, which is a granite without quartz, is preferable when it is in a reasonably fresh condition, but if badly weathered it is even more objectionable than granite.

From the point of view of abrasion, marbles are to be classed among the poorest of all stones used in road construction. Their hardness when pure is about 3 in a scale of 10. They are very brittle and consequently quickly pass into a condition of dust under the impact and shearing forces of passing vehicles. Their structure (see Pl. III) is granular and the calcite composing them possesses a very pronounced tendency to break up into rhombic grains, a tendency which serves further to increase the weakness of the stone.

The property of cementation of road stones is not well understood.

This condition of things arises from the fact that the operation of cementation has not been long recognized as one of the qualities of a good road metal, and because an acquaintance with the processes is one that is difficult to approach. As a result of considerable speculation by the writer, the processes involved seem to be due to several causes. These are: (1) Adhesion between the dust particles produced by capillarity; (2) the binding property of fine material possessing a small quantity of clay; and (3) the induration resulting from the deposition of calcite or other substances when the road's surface becomes dry, which were held in solution in that zone of the road that serves as a roof to the substructure.

The part played by capillarity would be affected by the form and size of the dust particles, and this would also be true of the last two processes. Traps in decomposing yield among other substances a certain amount of calcite, clay, quartz, and iron oxide. The dust which results from abrasion of these rocks, owing to the character of the minerals present, is possessed of flat surfaces which would increase the effect of capillarity and the binding power of the clay. As the dust dries the broken stone is more or less indurated by the amount of calcite and iron oxide present in solution. In granite the comparative absence of iron-bearing substances, the relatively less amount of calcium minerals, (which might give rise to calcite when decomposed), as well as the variation in the character of their dust, would all operate to decrease the effect of the above processes.

In marbles cementation as resulting from the deposition of calcite would attain its greatest effect, only influenced by the presence of other substances in the rock. Experiments to ascertain recementation properties have only just begun, and the data at hand throw little light on this subject.

The injurious effects of organic and inorganic acids on road stones are confined for the most part to rocks containing calcite or dolomite, minerals which they readily dissolve and carry away. It is probable that in most road metals, although their action serves to increase the power of water to hold substances in solution, which may be dropped as indurating material or removed from the roadway, that the tendency is rather to promote consolidation than otherwise. Acids are objectionable, however, for other reasons.

Not a little of the loss of substance sustained by a road is caused by wind and water action, and rocks whose minerals are of a high specific gravity and are free from mica are best adapted to resist these processes of destruction. As quartz is one of the lightest of the common minerals, rocks which are composed of it to a great extent are undesirable for this as well as for other reasons already stated. It happens that the traps are relatively of a high specific gravity and therefore are less liable to suffer from these forces. Granites or traps which contain mica in any abundance are to be looked upon with suspicion as road



GRANITE, SHOWING GRANULAR STRUCTURE.

stones, as the mica is quickly transported by wind and water action, notwithstanding the fact that it is heavier than the feldspar or quartz. The calcite of marbles is of greater density than quartz, but the readiness with which it becomes pulverized to an extremely fine condition makes it very susceptible to these forces.

RELATION OF DECOMPOSITION TO CEMENTATION.

The calcite derived from the alteration of the feldspar, when deposited from solution during dry periods, acts to a limited extent as a binding material, tending to strengthen the rock dust and increase its attachment to the broken stone. This is true of several other substances.

As furnishing corroboration of the part played by the clay resulting from the decomposition of feldspar in cementing together the fragments of broken stone, the results of the laboratory experiments on road-building stones made by an adjunct of the Massachusetts highway commission may be cited. A study of the table printed in the appendix of the report of this commission for 1895, giving the cemented value of powdered rock of various kinds, shows that the maximum cementing value thus far observed was obtained from an olivine diabase which was much weathered. As stated above, the greater the weathering the larger the percentage of secondary clay and other substances.¹

The table also allows the generalization that, among the stones which are to be considered of importance in road construction, those having the highest cementing value are diabases and diorites, and usually the experiments on much decomposed specimens give a higher cementing value than for fresh rocks. A further study of the table shows that, although granite and syenite contain a great amount of feldspar, the cementing value of these rocks is much less than that possessed by diabases and diorites. The essential differences between these rocks are the presence of quartz in the two former, the shape of the individual minerals composing them, and differences in mineral arrangement and chemical composition. Quartz in granite and syenite occurs in rounded and angular grains. (See Pl. IV.) The minerals, pyroxene, hornblende, and feldspar in diorites and diabases, on the contrary occur in prismatic and tabular forms. (See Pls. I and II.) Here are striking differences in the habit of the minerals constituting these rocks, and the action of cement upon the powder produced from them is very different also. In the case of granite and syenite the shape of the grains after crushing is irregular, the quartz having curved surfaces. Cementation

¹In view of the prominent part probably played by secondary clay, calcite, and hydrous oxides of iron resulting from the weathering of feldspar and iron-bearing minerals in the cementation of broken stone, it will be well in making laboratory experiments with road metals to ascertain the amount and kind of such products of decomposition as furnishing a possible means of determining the relative value of road stones and the explanation of the phenomenon of cementation.

and capillarity will not be so strongly exercised upon grains of this nature as upon those of crushed trap. The cleavage of the feldspar, hornblende, and pyroxene, their tabular character, furnishing as they do planes of weakness in the minerals composing our dike rocks, cause their powder to have flat faces. By the interlocking arrangement of these grains and the increased effect of capillarity, due to their tabular form, we should expect that the cementation value of the rocks would be the highest, and experiment only emphasizes the correctness of this view.

THE EFFECT OF MOISTURE ON A ROADWAY.

The part played by water on crushed stone while undergoing rolling is several fold. In practice broken stone completely wet down is thoroughly rolled with a roller weighing ten or more tons. The wet surface of the angular rock fragments permits a more thorough compacting, as the water acts as a lubricant, allowing the stones to slip by one another with greater freedom than would be the case were the fragments dry. At the same time the water retains the powdered rock resulting from abrasion of the particles and holds it between the fragments. This process is reactionary and cumulative, for the presence of the powder of attrition acts through capillarity to take up and retain still greater quantities of water until the spaces between the pieces of broken stone composing the upper part of the road become completely filled with powdered rock. Not a little of the cementing, or bonding of a road during rolling is in reality the effect of capillary existing between the grains of powdered rock and the adjoining walls. This principle may be observed on our seashores and sand roads. While wet, the beach or road may be firm and unyielding, allowing heavily loaded teams to pass over them, but when dry such places are impassable for heavy teams and difficult of passage for all kinds of vehicles. In this case cementing, as ordinarily understood, plays no part in producing adhesion between the grains. Upon drying, the grains are entirely free to move over one another, having lost the water which served to bind them together. When a macadam road is thoroughly compacted a careful inspection will show that the fragments of broken stone are closely packed together and the spaces between are filled with a fine powdered rock, which, if derived from a suitable road material, carries a small percentage of clay. Any of our commonly used road stones contain an appreciable quantity of clay disseminated in little particles in the feldspar whence it has been derived by the weathering of the rock prior to its removal from the quarry.

As already stated, the microscope shows that the feldspar of our traps and granites and other road stones is never entirely free from a considerable amount of kaolinization, or alteration to clay. This change has taken place in the crust of the earth to a great depth, and no road material can contain feldspars free from more or less of this mineral,

depending upon the character of the rock and the amount of weathering to which it has been subjected. By the gradual wearing of the feldspar, by the abrasive action of the roller, the wheels of carriages, and the feet of animals, a small but important quantity of clay is liberated, and this in combination with any clayey material that may have been added to the road serves to furnish the necessary quantity of cement to knit the broken stone firmly together. It is not to be understood that an appreciable quantity of clay acts otherwise than objectionably when used in road building. As a rule nothing is more undesirable than the clay element in highway construction, yet a little mixed with some of our Southern limestones serves to increase their cementing and enduring qualities. Upon drying, the powdered rock sets much after the manner of a sandy clay and serves not only to bind the pieces of rock together, thus giving rigidity to the way, but to retard the wear due to any differential motion of the fragments over one another while the load is passing along the road. A wetting of the superficial portion of a roadway during rains tends by the expansion of the cement to knit the surface together and make it impermeable to the passage of water.

From a theoretical standpoint it would seem probable that a certain condition of moisture, instead of being objectionable to a roadway undergoing constant use, is rather desirable than otherwise. A condition of moistness serves to prevent loss of material worn fine by the abrasive action of the wind, and the presence of a thin film of wet dust acts as a cushion to protect the fragments of rock from the rude touch and impact of passing traffic, thus lessening the wear and tear of the surface. In the same manner the moist cement operates to distribute the bearing surfaces of the broken stone and to reduce the local intensity of the friction between one rock and another, although cement in this condition will tend to allow a greater freedom of movement among the broken stones, and hence in this way make the surface more yielding. Assuming that the loss through increased abrasion of material resulting from moist cement between the rock fragments is equal to the saving due to the cushioning effect of a small quantity of moisture on the surface, there still remains a saving to the road by the protection afforded by preventing excessive loss through the action of the wind.

It is the custom in England to plant hedgerows beside macadamized roads in order to insure a rapid drying of the road after a rain by the sun's action; in Germany it has been the practice to plant fruit trees, particularly the cherry; while in France the mulberry tree may be seen along the roadsides, serving the double purpose of food for silkworms and shade. Here is a radical difference in practice, and it would seem that, from a utilitarian as well as an artistic standpoint, the custom on the continent is to be the more commended, especially as by the latter system the trees serve to protect the roads from the excessive action of

the winds. In the one case there is no shade to protect the traveler from the sun's rays; in the other the shade is often very dense. In this country no precedent has been established in the matter. The States in deciding this question must of course consider latitude and longitude as affecting the character of the trees that will flourish therein and their relation to climatic conditions; but it is to be hoped that whenever feasible fruit-bearing trees will be set out, due consideration being paid to the character of the foliage, whether it be dense, high or low; the beauty of the trees; their rate of growth; their endurance, and other characteristics.

In the latitude of New England the chestnut has many qualities which commend its coming into general use in road decoration. It ranges from Maine to Mississippi and westward to Michigan. It is often 100 feet high, with a trunk varying from 3 to 12 feet in diameter. On glacial drift it grows to a large size and lives to a great age. It possesses a stout root which descends perpendicularly; its leaves turn a beautiful color in the autumn, and its annual yield of nuts speak for its utility as well as other desirable characters. In the *Silva* of North America, by C. S. Sargent, Vol. LX, page 15, may be found the following description:

The chestnut, *Castanea dentata*, is one of the most useful and beautiful trees of the forests of eastern North America. No other tree grows so rapidly or to such a great size on the clay gravelly hills of the Northeastern States. Always beautiful, with its massive trunk, its compact round-topped head, and slender dark green leaves, in early summer, long after the flowers of its companions have disappeared, the chestnut covers itself with great masses of spikes of yellow flowers, and is then the most magnificent object in the silvan landscape.



United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

WASHINGTON, D. C., *March 1, 1898.*

SIR: I have the honor to transmit and recommend for publication, as circular No. 30 of this Office, a paper prepared by the special agent of this Office, Mr. E. G. Harrison, C. E., on the Repairs of Macadam Roads, together with letters of experienced road builders upon the subject.

Respectfully,

ROY STONE,
Director.

HON. JAMES WILSON,
Secretary of Agriculture.

REPAIRS OF MACADAM ROADS.

By E. G. HARRISON, C. E.

Where funds have been provided for road improvements, the efforts of the friends of good roads have been directed toward building as much road as possible, while the matter of maintenance has been entirely overlooked, and no funds have been provided for needed repairs. The fact that no great inconvenience or damage arises from a slight depression in the road surface, or from a few loose stones, occasions neglect, and the condition of the road is allowed to become gradually worse. When the surface becomes, in time, so rough as to be a public nuisance, it is found that the cost of restoring the road is considerable; moreover the roughness of the road in the meantime has caused a "wear and tear" to wagons, carriages, horses, etc., which is, in the aggregate, of considerable importance.

This neglect of repairs to public roads is very poor economy. If railroad corporations were to put their roads under this kind of treatment they would soon go into the receiver's hands. It would be a remarkably well constructed road that would not show some defects soon after it began to be extensively used. With the greatest possible care an earth roadbed can not be made strictly uniform as to solidity, and heavy loads passing over the crust formed by the stones will press some of the stones into soft places in the earth bed, and this in time will cause a defect on the surface of the road. A very slight depression will at first appear, which may be detected only after a rain (by the water which will remain for some time in the depression). If this depression is permitted to remain it will soon become deeper and broader. As the wagon wheels go in and out of it they grind out the stone softened by water, and cut down the sides, so that what was at first a slight depression soon becomes a hole. Such neglect causes subsequent repair to be expensive.

CAUSES WHICH MAKE REPAIRING NECESSARY.

It will be well to consider some of the causes which make repairing necessary, so that they may be avoided or removed as far as possible. They are:

- (1) Defective construction of earth bed.
- (2) Failure to cut off under-ground water by drainage.
- (3) Rain or storm water which is permitted to lie in pools along the roadside or in side ditches which do not carry the water from the road.
- (4) The side slope being insufficient to carry the storm water from the road to the side ditches.
- (5) The longitudinal grade of the road being greater than the slope from center to sides.
- (6) The formation of ruts.
- (7) Raveling, or picking up loose stone.
- (8) Surface stone not of proper quality and not uniform.
- (9) Roadbed not sufficiently compacted.
- (10) Accumulation of trash or rubbish on the road.

These causes will now be considered and remedies suggested:

(1) Defective construction of the roadbed results in a subgrade or earth bed which has not been thoroughly compacted, but contains spots of soft earth. This soft earth should be removed and replaced by other earth, so as to make the whole roadbed surface as uniform as possible. If this is not done heavily loaded teams passing on and over the finished road will press the stones down into the soft places in the roadbed and will make a depression in the surface of the road, which will be filled with water during rains. The water will afterwards percolate through the stone bed, making the earth still softer, and the depression will soon become greater, as above-mentioned. The remedy in this case must be applied to the roadbed itself, for after the stone has been put in place defects in the roadbed can not be cured.

Wherever a depression large enough to hold a shovel of broken stone appears in the surface of the finished road the loose material found in the hole should be taken out, the hole filled with new stone broken to a size not larger than one and one-half inches, and material taken from the hole spread over the broken stone surface for a binding. It should then be compacted by ramming or rolling until it is made to correspond to the rest of the road surface. The broken stone should in no case be left lying loose, for this allows the storm water to pass through, and the earth continues to soften; moreover, many of the loose stones would be scattered over the road surface and would become not only bad for horses' feet and damaging to wagons, but uncomfortable for those who ride. Loose stone on a hard stone surface loosens the other stone when loaded teams pass over them.

(2) Many roadbeds become soft and irregular, because the under-ground water was not cut off by drains when the road was constructed. This is one of the principal sources of the many defects in roads which cause depressions and ruts. To remedy this defect tile or stone drains should be placed a short distance from the roadbed on the side nearest to where the springs are supposed to have their source. If it is uncertain on which side of the road the springs

rise, drains should be placed on both sides at sufficient depth to cut off the under-ground water. When water is permitted to pass under the roadbed, as soon as it strikes soft earth or sand it rises by capillary attraction to the surface and softens the earth bed. Much of the cost of road repairs could be saved by proper attention to drainage.

(3) Pools of water should never be allowed to remain along the roadside or in the ditches; the latter should always be kept open and clear, so that all storm water may pass to the nearest natural waterway. The surface on the sides of the paved roadway should always be kept at proper slope to carry water to side ditches, and no holes or obstructions of any kind allowed to stop the free passage of water from the road to the side ditches. Water in pools along the road will soften the earth, and much of it will pass down until it comes to a hard stratum and will then follow the dip of the stratum, which may take it under the stone construction, where it will act in the same way as water from springs. By proper attention this cause of repair can easily be avoided.

(4) When stone road surface has not been constructed with sufficient slope or grade from crown to side ditches, so that all the storm water does not pass off quickly, but remains in the slight depressions and wagon tracks, the road surface will become soft and will wear more easily. Dirt which is carried on by wagon wheels, will also remain and accumulate when there is not sufficient grade to carry it off with rainfalls. The remedy is to place enough stone in the center of the road to give it the required slope or grade, which should never be less than one-half inch to the foot. Care should be taken to keep the earth surface between the metal construction and the side ditches of the same grade, if possible, and in no case of less grade.

(5) When the longitudinal grade is greater than the slope from center of road to side ditches, the water from rainstorms and melting snow will follow the metal construction with the run of the road, increasing in quantity and force according to the length of the grade, causing washes in the road surface.

It is better to construct a road on a grade not exceeding five feet to the hundred, and then the slope can be made 6 or 7 per cent. But there are cases where it is not practical to so change the grade of the road as to reduce it to 5 per cent, and the road can not be relaid so as to avoid the steep grade. In such cases the best possible remedy must be applied. To take the water from the metal construction, a cut or depression can be made at certain intervals, starting at about two feet from the crown of the road and running diagonally with the grade to the side ditches, widening and deepening as it gets near to the side ditches. It need not be so deep as to inconvenience the travel, but deep enough to carry off the storm water. The greater the grade the more cuts will be required.

(6) Ruts are generally formed by the use of narrow tires on wagons carrying heavy loads. They are more easily formed when the road surface is soft, but narrow tires with heavy loads will cut out the stone and form ruts on the hardest surface, particularly on narrow roadbeds. A two-inch tire soon wears away on the sides so as to become only one inch wide on the bearing surface, and the whole weight of wagon and load is supported on about four square-inches bearing on the road surface. When in motion it tears away the

stone, making holes and forming ruts when allowed to run in the same tracks, a condition which can not well be avoided on narrow roads. The ruts deepen and harden by use, and the horses finding less resistance to the wheels in the ruts, will walk so as to get the wheels to follow the ruts. Wide tires will greatly prevent ruts, but even wide tires will make ruts if allowed to run continually in one track.

In order to get travel distributed over the road so as to prevent the formation of ruts, this plan is recommended:

Have a doubletree made of such length that the ends will be in line with the wagon wheels, the singletrees to which the traces are attached being attached to the ends of the doubletree will bring the horses directly in line with the wagon wheels, and the wheels will follow the horse and pass over the road where he steps. As the horse will not walk in a rut or go into a hole unless compelled the wagon wheels also will avoid them. If the horses' sharpened shoes should loosen any stones, the wide tires of the wagon wheels following him would roll it into place again.

Another plan to prevent ruts, and at the same time to improve the road by use, is to make the axletrees of the wagon of different lengths, so that the wheels on the front axle will not be followed by those on the rear axle. Here is an experiment with its result:

During the three years 1890-91-92 a test of the use of wide tires in practical work was made on the four and a half miles of road between Split Rock and the works of the Solvay Process Company, near Syracuse, in Onondaga County, N. Y. Mr. Frederick M. Power (superintendent of the works and a member of the board of county supervisors) gave the writer the following statement regarding this test:

The wagons were constructed in our own shops, and the wheels were furnished by the Archibald Wheel Works, of Lawrence, Mass. All wheels were of ordinary diameter. I built one wagon with wheels of following dimensions: Front tires, seven-eighths inch thick and 4 inches wide, and distance between front wheels (or gauge) 4 feet 5 inches; rear tires 1 inch thick and 5 inches wide, and the width between rear wheels 5 feet 8 inches. I built another wagon with front tires five-eighths inch thick, and rear tires 1 inch thick. The front tires were 4 inches wide, and rear tires 6 inches wide. A third wagon was considerably lighter. It had 4-inch tires, front and rear, with ordinary gauge in front, and a gauge of 5 feet 9 inches in rear. All tires on this wagon were seven-eighths inch thick. These wagons were all "poled" for three horses, and the use of three horses tended to combine with the wide tires and varying gauges of front and rear axles to smooth down even the slightest ruts caused by wagons of narrow tires and ordinary gauge, of which there were and are very many in use on this road.

The constant use of these wagons during the time noted produced a smooth, compact and regular surface on the road between the quarry and our works, and the substantial crowning of the road has kept the surface well drained and, therefore, dry and free from ruts. These wide tires and varying gauges excited a good deal of attention at the outset, and conflicting opinions were expressed regarding their utility. The result is eminently in their favor, and the general sentiment has grown constantly in favor of the use of these wagons for heavy loads. We continuously haul loads varying in weight from 8,000 to 10,000 pounds with no perceptible wear, weakness or breakdown either to the wagons or to the roads. The carts used at our works are varied in gauge, and all have given excellent satisfaction in keeping the roadway smooth. When these wagons were first put into use the road was rough and rutty and the work of hauling was severe on the horses, but soon the broad tires began to roll and pack the road surface, and it is difficult to exaggerate the great benefit these tires have produced by keeping the road smooth and hard, and the amount of labor they have saved in the work of hauling and repairs.

The cost of hauling stone has been reduced from 80 cents to 60 cents per ton, and a team can easily earn from \$3.50 to \$4 a day hauling wall stone, and making two round trips of nine miles each, or a total of eighteen miles.

In the older countries where stone roads have existed for many years, a variety of plans have been suggested and put into practice to save roads from wear and tear, and thus reduce the cost of maintenance to as low a point as possible. Wide tires have been found to be, not road destroyers, but, in a manner, smooth road makers. The following extract is from a publication by Isaac B. Potter, Esq., of New York, entitled "Good Roads," which contains much valuable information on the road subject:

In France the wagons used by the merchants and farmers have wheel tires ranging from three to ten inches in width, the most usual width being from four to six inches. The large freight wagons (four wheeled) have tires rarely narrower than six inches, and the rear axle is about twelve to fourteen inches longer than the front axle, so that the rear wheel tracks will lap the tracks made by the front wheels, and so widen the space of roadway rolled by the wheels. Many other four-wheeled vehicles in France are also supplied with axles of varying lengths. In Austria tires for wagons carrying $2\frac{1}{2}$ tons are each $4\frac{1}{2}$ inches in width, and those for wagons carrying $4\frac{1}{2}$ tons are about $6\frac{1}{2}$ inches wide. In Bavaria the width of wheel tires is fixed by law as follows:

- 2 wheel carts with 2 horses, 4.133 inches;
- 2 wheel carts with 4 horses, 6.180 inches;
- 4 wheel carts with 2 horses, 2.596 inches;
- 4 wheel carts with 2 or 4 horses, 4.133 inches;
- 4 wheel carts with 5 to 8 horses, 6.180 inches.

Carts with more than four and wagons with more than eight horses are not allowed to use the road without a special permit from the authorities.

In St. Louis, Mo., an ordinance requires that a vehicle having an axle 2 inches in diameter shall have tires $2\frac{3}{4}$ inches wide, and a vehicle having an axle 3 inches in diameter shall have tires of proportionate width, all duly regulated by the ordinances. Several States have passed laws to encourage the use of wide tires by granting a rebate to road taxes of from fifty cents to one dollar per wheel for wagons carrying one ton and over. The State of New Jersey during the past winter made an advance movement on that line by the passage of the following:

AN ACT to encourage the use of broad tires on wagons and carts by a rebatement of taxes.

Be it enacted by the Senate and General Assembly of the State of New Jersey:

1. Township committees or governing bodies of any municipality, be, and they are hereby directed to allow a rebate of taxes for township, road or street purposes, to all owners of wagons, carts or vehicles having tires of not less than four inches in width, used in said township or municipality for transportation of goods, wares, merchandise, produce or for general farm, freight, or express purposes, drawn by two or more horses or mules or a team composed of one horse and one mule; said rebate shall be two dollars for each wheel in habitual use on the highways of this State on the first day of April, Anno Domini one thousand eight hundred and ninety-seven, and a rebate of one dollar for each wheel habitually in use, as aforesaid, on April 1, Anno Domini one thousand eight hundred and ninety-eight; and provided further, that the owner of each vehicle having tires of not less than four inches in width, upon which there is a difference of at least eight inches in the length of the front and rear axle, so constructed that the front and rear wheels will not come in contact with the same road surface while the vehicle is moving in a straight line, shall receive, in addition to the above rebate, a further rebate in his or her tax as aforesaid of four dollars for each vehicle of this class for each and every year that said vehicle is habitually used upon the highways of this State; and provided further, that on April first, or when the regular tax assessment is made during the year one thousand eight hundred and ninety-nine, and during each and every year thereafter, it shall be

the duty of the assessor to inquire for and assess any and all wagons, carts, or vehicles capable of conveying wares, merchandise, produce, freight, or express goods, drawn by two or more horses or mules as aforesaid, used upon the highways of this State; said vehicle shall be subject to a special road tax of one dollar for each wheel of a less width of tire than four inches, said special road tax to be assessed and collected as other taxes and to be applied to the road fund within said municipality.

2. This act shall take effect immediately.

The turnpike corporations in Pennsylvania have for more than fifty years past recognized the value of broad tires passing over their roads, and for the encouragement of this use make a deduction of one-half of the usual rate of tolls on wagons with tires not less than four inches in width.

(7) Raveling or picking up loose stones is made possible by the moisture being taken from the binding material. The stones on the surface of the road become loose and are easily displaced both by the horses' shoes picking them up and by the wheels. This can be remedied only by applying water to the road surface, but as it happens in dry, hot weather, the water when applied soon evaporates, and watering on country roads is expensive. If the lengthened doubletrees before mentioned are used with wide tires, the wheels will pack into the roadbed as they pass over them the loose stones picked up by horses.

It is the light travel, particularly with one horse, that causes much of the displacement of surface stones in dry times, and there seems to be no way to avoid it. When sprinkling is too expensive a light coat of gravelly sand or clay gravel may be applied with good effect, as it will restore the binding. This should be well rolled to bed the already loose stone. Clay earth should never be used, as it will pick up the stone where wet.

Whenever it is practicable, stone roads should have an earth or gravel roadway on each side of the stone construction, or at least on one side. This was always done in the early construction of macadam turnpike roads in Pennsylvania. They took the name of "summer roads," from the fact that they were preferred for light travel in dry weather and during the summer months. This saves the stone road from much damage by raveling. Roads constructed in this manner are much less expensive to maintain, and it will be found that the extra cost for side roads will be the most economical way to preserve the stone-road construction.

(8) Much of the general repair to stone roads is due to the stone used for surface being of an inferior quality. The sedimentary stones are often used, such as limestone, shale, slate, sandstone, mica schist, and many stratified stones. Some of this kind of stone will dissolve when exposed to rain water followed by heat, and some are disrupted by frost because they absorb water. Whenever it is possible none other than igneous or volcanic stone should be used for surfacing. The sedimentary stone above-mentioned and others of like kind can be used in the foundation, but the surface stone should be hard and tough. They should wear smooth and not be liable to crush. What is now generally known as trap rock is to be preferred when it can be obtained.

Limestone is found generally throughout this country. The harder kind of limestone, that which contains much silica or crystallized matter, is the best. The soft limestone should not be used, as it

soon grinds into dust or dissolves by action of water and air. Whatever kind of stone is used should be as far as possible of a uniform character. It is the hard and soft stones placed on the surface together that cause roughness and holes.

(9) The material for the road may all be of the proper kind, but if this material is not put together properly the road will be expensive to maintain. The material should be put on in layers and thoroughly compacted by repeated rolling of each course, so that when finished it will be impervious to water.

A stone road properly constructed will not soften after rains or be disturbed by freezing. The water will be cast off at right angles to the center of the road to the side ditches, and the road surface will only need repairing where the stone wears away legitimately under the wheels of the wagons and the horses' feet. Maintenance solely from these causes will not be found costly.

(10) The road surface should be kept clean. A road surface, dirty from wear, and from dirt brought on by wheels from clay roads or from leaves or trash of any kind, which are allowed to remain on the surface, soon begins to wear and to be in need of repair. The dust from wear is often blown off, but may be found in considerable quantities in sheltered places. If allowed to remain, rain turns it into mud, and the stone bed will be softened and ruts and dishes formed. It will be found economical to have all surplus dirt removed. It does not cost much if attended to promptly. The dry dust can be removed by sweeping and the dirt and mud by scraping with hoes. Such material is so mixed with droppings of horses that it contains considerable fertilizing matter and can frequently be sold for enough to pay for sweeping, scraping, and removal. A clean road is not only important, economically considered, but it adds greatly to the comfort of those who use the road. Roads are constructed and maintained for the comfort as well as the pecuniary benefit of those who use them.

RESULT OF INVESTIGATIONS AND PERSONAL OBSERVATIONS.

Having given some of the most important causes which make repairs to roads necessary, the remedies in some cases which would remove the causes, and the manner of restoring or repairing the road, I will now give the result of my investigations and personal observations and the methods of some of those having charge of the repairs of improved roads, as supervisors, overseers, path masters, etc. I have found it impossible to get at any exact account of repairs to improved roads. They are generally mixed in with repairs to the common roads under the charge of the same officers, so that it is impossible to separate them. In many places where counties have improved their leading roads the matter of repairs, under some arrangement, has been placed under supervision of local officers.

From the statements made by officers of some of the turnpike corporations near Philadelphia a correct account of maintenance can be obtained, but it will not give much idea of the cost of maintaining the average country road. The accounts which these turnpike companies furnish show the cost of yearly repairs per mile. The turnpikes are, in a manner, avenues or streets extending from paved streets in the city out into a thickly settled country, and are con-

stantly traveled by heavily loaded teams and light carriages. The travel brings in a large revenue from tolls, which provides funds for extensive repairs, and pays the stockholders a good dividend.

The corporations find that roads kept in excellent order induce travel, and hence, increased revenue. The annual cost of repairs runs from \$200 to \$400 per mile. Some of the corporations expend half of this amount in sprinkling the stone roads, which amount is charged up to repair account, because it saves the road from ordinary wear and tear. While we can not obtain data from the accounts of these turnpike corporations that will enable us to come to any exact conclusion as to what the repairs to an ordinary country road should cost, yet we can profit by the long experience of these corporations in maintaining these roads by constantly making the repairs as they are needed, and by the use of water to save the roads from wear and tear in dry seasons.

Inquiries in regard to repairs to roads improved under county systems show that no regular methods have been adopted. The tendency on the part of the officials seems to be to expend as little as possible for repairs, and to extend the construction. This plan brings about a very undesirable state of affairs; repairs are neglected, the road becomes rough and uncomfortable for travel, and creates a very unfavorable impression of the stone road system. Finally the indignation of those who use the road becomes aroused, and by entreaty, persuasion, and sometimes threats to go into the courts they cause action to be taken. Then the road is found to be in such a condition that nothing but a resurfacing will answer. This occurs on some roads after six years of wear, on others eight and ten years, according to amount of travel and the original construction of the roads.

The average cost in these cases is from one hundred to two hundred dollars per mile per year (I have in no case been able to get exact figures), and the practice is not to be advised. The officials in some of the counties which have adopted county system for leading roads, and also in some where State aid has been given to construction, place the repair of the roads under local supervision; that is, the township overseers keep the county roads in repair in their separate townships and render bills to the county.

In some few counties a county engineer has charge of repairs as well as of construction. Where this is done the repairs are more satisfactory. The work is better and more cheaply done. Where the matter is placed in the hands of a competent person, and he is held responsible for the condition of the roads, good work is almost sure to follow.

Having personally investigated various methods of road repairing, and procured facts in relation thereto from engineers, supervisors, overseers, path masters and others having charge of public roads, I find a great variety of practices—they certainly can not be called methods. They simply follow what they have seen practiced for many years and what has been handed down through many generations. Not regarding the changed condition from an earth road to one of stone they think a stone road can be repaired when in holes, by filling with earth, and when travel passes over it and it becomes, in dry weather, comparatively smooth they seem to be satisfied with their job and think they have saved a great deal of expense by not using broken stone.

When this kind of repairing is done in the spring, the earth soon becomes powdered into dust and is swept from the roads by winds; more clay, earth, or mud is then applied, and so this kind of work goes on. If it is done late in the season, the earth, in wet times and during freezes, is a great nuisance, and is washed into side ditches, from whence it is taken again and put on the road, only to repeat the same thing. This kind of repairing, which is thought cheap at the time, is really very expensive, and costs more in a few years than if broken stone had been properly applied.

Sometimes stone chips from quarry wastes, cinders, or screenings from rock crushers are used to fill depressions and smooth the surface. This is a faulty practice as there is little wear in small broken stone, and they soon grind under loaded teams, into dust and dirt, both of which become destructive to the stone road.

COST OF ROAD REPAIRS.

In response to inquiries sent to engineers, supervisors, overseers and persons in charge of road repairs, a number of replies have been received. These, if noticed here in full, would prove a matter of great interest and value to those seeking information on the subject of road repairs, but the cost as given might prove misleading from the fact that these roads, or many of them, have been built within the past few years. They will in time (varying according to the amount and kind of use, quality of material used for surfacing, and method of construction) need resurfacing. This will cost a considerable amount, and should be taken into consideration in determining the average of the annual cost of repairs. They would, besides, take up too much space for the limits of this paper. I will, therefore, as far as possible, condense the answers to the several inquiries.

The cost varies with the season. When the summers are dry and hot, the surface of roads constructed on dry sandy soils, wherever exposed to sweeping winds, is liable to ravel, and sprinkling is the best remedy. The necessity of repairs is also increased by frequent showers. There is very little, and in many cases no expense reported for repairs from this latter cause. In replying to the inquiry: "What is the annual cost of repairs to stone roads per mile?" we get estimates varying from ten dollars to one hundred dollars per mile. Only those roads which might be called avenues, leading into large cities or market towns, have exceeded the last amount.

Unusually heavy storms and rains, which wash and damage the steep grades and destroy culverts and bridges, add considerably to annual repairs.

In answer to the question: "Is the cost of repairs to a stone road greater or less than the amount expended on the same road before it was improved?" the general reply is, that the cost is less for the stone road.

In some sections of the country gravel has been extensively used for road improvements. The replies bearing on the comparative cost of repairing stone and gravel roads show that the cost of repairs to gravel roads is from two to three times the greater. In many cases these gravel roads have become entirely worn out in a few years. Large sums of money invested in gravel turnpikes have been lost, for the reason that the tolls would not, after a few years' use, be sufficient to keep the road in repair.

It is a fact that the most important roads have been the first to be improved by being stoned. To the inquiry: "Has travel increased on the roads improved by stoning?" the replies show that the travel usually doubled, but in many cases it is three and four times greater after improvement.

It is stated that heavily loaded teams will go several miles out of their way to take advantage of a stone road. Market travel is diverted from the common dirt road, particularly during the seasons of the year when traveling on dirt roads is difficult, and the stone road is sought, although the distance is increased many miles.

To the inquiry: "Has the wear and tear to roadbeds increased by reason of larger or heavier loads being used on them?" the replies vary according to locality. In some of the trucking, or farm-gardening, districts, it is stated: "The number of baskets of truck put on a market wagon before the improved roads was from forty to sixty; only in a few cases, where the common roads were better than usual, did they carry seventy baskets. Since the improved roads new wagons are constructed especially to carry truck suited to the new condition; they carry from one hundred and fifty to one hundred and eighty baskets, still using two horses to draw them." The wagons carrying manure formerly carried from one to one and a half tons as a two-horse load. Now the strength and weight of the wagon is increased, so that from four to five tons are drawn by two horses. This, of course, has caused the wear and tear to increase, particularly where the old narrow wheels are used. The ease with which manure is carted now, and the large amount which can be drawn with one team, has stimulated truck raising and market gardening, and there is greater increase of this kind of teaming. Under these circumstances it would not seem right to compare the cost of repairs of the road before it was improved with the present cost of the repairs of the improved road for the purpose of proving that the improved roads are a greater tax on the people than common roads.

The replies concerning the method of repairs and the remedies are embraced in the treatment of "Causes of repairs and the remedies." I would here repeat, and it can not be too firmly fixed in the minds of those having charge of roads, that if they will do the work as soon as needed, keep side ditches and waterways free from obstructions, and use other precautions to prevent the roadbed from being destroyed, the cost will be found much less than if they attend to the matter annually or occasionally, a practice which has heretofore been almost universal.

As before stated, to get exact data concerning the cost of any kind of repairing to stone roads is an impossibility at this time. Probably it is too soon to expect the matter to be reduced to a system, but there is no good reason why an attempt should not be made to start a system which would keep the cost of repairing stone roads separate from other charges, so that the cost of each year on each road could be known. The taxpayers who furnish the money have a right to know just how their money is expended, and public officers having charge of the repairs of roads should be obliged to keep correct accounts and publish the same annually for the information of the taxpayers. If an officer is not competent to do this he should not be retained in office. In States granting State aid the law should make it obligatory for the county official to put the matter of road

repair under the supervision of competent persons to be approved of by the State officer in charge of the road system. The county officer in charge of roads should be compelled to make a report and statement showing the cost of repairs on each road separately. Among the advantages of this might be mentioned:

ADVANTAGES OF REPORTS BY COUNTY OFFICER.

1. It would place the responsibility of road repairs for the county upon one person, and he would be more likely to be selected for his ability to perform the duties, to keep the accounts, and make up an intelligent report.

2. It would enable the taxpayers to see what the repairs cost, and by comparing the cost of repairs of one road with another, and of one county with another, they could form an idea as to the economy or the extravagance used in road repairs.

3. The cost of all repairs on roads built under State aid would be information very valuable to those interested in road improvements, as well as to those having charge of the roads.

The county officer having charge of repairs could not be expected to look after the details of repairs on all roads. The plans adopted by the old turnpike corporations seem to be the most practical. Let the roads be divided into sections of from three to six miles each, the county to furnish the material for repairs and place the same at convenient points along the road. The person appointed to keep the section in repair should be paid by the year for putting on the material, cleaning out side ditches and culverts, and keeping the road in repair as required by the county engineer. He would then soon learn that it would be to his advantage to go over the road after every hard rain or shower and remove any obstructions found in the ditches that would divert the water so that it would be liable to make a wash. He would also see any hole or depression in the road surface and immediately fill it. In fact, he would soon find the wisdom of "a stitch in time saves nine," and the road would be kept in constant repair at a comparatively small cost. It might take a few years of experience to fix the proper sum for the amount to be expended in each section, but it would soon adjust itself. There are always persons living along or near the line of these improved roads who will be willing to "take their chances" in getting something out of the job. Persons will be found also who will take a pride in keeping their sections in good order so as to receive the commendation of the public, and particularly when they find, as they soon will, that "an ounce of prevention is worth a pound of cure," and that a road attended to on this plan, and promptly repaired when needed, costs much less, on the whole, than one which is neglected.

It might be found advisable in the start to give the repairs on the different sections to the lowest responsible bidder. It would encourage competition. But when a good man is secured, one who will do his work well and take an interest in it, it will be found more economical and satisfactory to retain him than to run the risk of getting an incompetent person whose only thought would be to make something for himself. These matters must be left with the county engineer and the county officials in charge of the roads. It would be advisable for the county officials, or where the body is a large one, a

committee of them, to go over the improved roads with the county engineer before he makes his annual report, so the committee may see the condition of the roads and judge of the competency of the overseers in charge of sections.

Too much pains can not be taken to keep improved roads in constant good repair, as it will add comfort to those who use them, save wear and tear of horses, harness and wagons, and save very much in the general cost of maintenance. This will in the end greatly aid the good roads movement.

Letters from A. J. Cassett, Thomas H. Martin, and others.

HAVERFORD, MONTGOMERY COUNTY, PA., *May 31, 1897.*

DEAR SIR: * * * Ours is more of a suburban than a farming neighborhood, for while a large part of the township is under cultivation, the land on both sides of the several railways traversing it is covered with groups of suburban houses and country seats. The taxable valuation of these properties brings the average valuation of land in the township up to about \$425 per acre, so that with a road tax of five mills, which has been the rate for a number of years past, the revenue available for the maintenance of roads is relatively large. In 1896, the road tax of the upper district of Lower Merion Township, of which I have immediate charge, amounted to \$18,303.85. There are thirty-four and fourteen-hundredths miles of ordinary dirt roads and twenty-eight miles of stoned roads in the district. The total amount of the road tax receipts is, however, not available for purposes of maintenance only. The country is building up rapidly, new roads are being opened every year and each year additional roads are being stoned. I regret that the subdivision of the expense accounts have not heretofore been kept in such detail as to enable me to give you with sufficient accuracy the cost of maintaining the dirt roads and the stoned roads. This is now being done.

There is nothing new in our method of building and maintaining roads. We follow the macadam system. After preparing the road-bed and ditches we lay on 6 inches of stone of even size, if trap rock, in cubes of one inch, or to pass through an inch and a half ring; if limestone, in cubes of one and one-half inches, or to pass through a 2-inch ring. As fast as this bed of stone is laid, it is watered and rolled, and then covered with screenings from the same rock and watered and rolled until the mass is hard and smooth. We lay the stone to a width of from twelve to sixteen feet, which is, of course, wider than necessary for a purely farming district.

When we first commenced our road improvements we followed the telford system, but afterwards abandoned it and adopted the macadam, and after a long experience with both I am convinced that for our climate and conditions it is infinitely superior to the telford.

The worst enemy of stoned roads in this country is long periods of dry weather, and it is astonishing to find on roads where there is considerable traffic how rapidly the telford roads wear down to the large stone forming the base. I can only account for this for two reasons: first, that the telford road is the dryer by reason of its construction; and, second, that the large stone act as an anvil and passing

wheels as a hammer, between which the smaller stone are crushed. Certain it is that the wear on a telford road is much more rapid. On the other hand, the macadam always wears smoothly and uniformly, excepting that the bond is liable to be broken in the early spring when the frost is coming out of the ground and the roads may be cut into ruts if there is any heavy hauling over it at that particular time, but to fill in these ruts and roll the road until smooth again requires very little labor and material, whereas when a telford road wears through nothing but a complete resurfacing is of any avail.

Yours very truly,

A. J. CASSETT.

MOORESTOWN, N. J., *April 8, 1897.*

MR. E. G. HARRISON.

DEAR SIR: * * * In giving you my figures of the cost of repairs to the stone roads under my care I said I could not tell exactly what they cost per year, as they went in with the general act. Two years ago they cost about \$40 per mile. That year was a very bad spring, with a great deal of early hauling of manure, and our roads got quite rutted. Since that time they have not been so bad, and we have also been able to get our stone for a less price. We have miles that have not cost us \$10 per mile; for instance, the mile on Chester avenue, from the Moorestown and Camden turnpike toward Riverton. Of course the expense of repairs depends largely on how far you have to haul the material. The Tom Brown road is the most expensive road we have.

The Tom Brown road has almost if not quite doubled its travel. Nearly all the farmers in the neighborhood use that road all the truck season, while before nobody except those who lived on it ever used it unless they were compelled, as it was practically impassable except in very dry weather. Now, on any morning in truck season you can see not only one or two, but a whole string going home who usually went through Moorestown.

A number of farmers around my neighborhood use the Chester Avenue road to go to market, although it is somewhat farther. People who ride for pleasure or business also invariably seek the macadam or telford roads. Nearly all those who live in the vicinity of Rancocos or above, in coming to Moorestown, come as far as the Hartford road and then across to the Borton Landing stone road and to Moorestown; and they return the same way. Many teams come the same way and then take the Haines Mill road to the Tom Brown, and thus on continuous stone road to the city. Before we had our improved stone roads two tons was considered a very heavy load for two horses, on a wagon weighing from twelve to fifteen hundredweight. Now, all our wagons built since weigh from twenty to twenty-five hundredweight and are loaded with not less than three tons, and often from four to five tons of manure, and are drawn by the same kind of a team. In fact, the team is not thought of; they simply load the wagon with what it will bear. If there is a piece of dirt road intervening that can not be avoided the only thing to do is to throw off part of the load at that point, and make two loads from that point. The difference in the number of baskets is from 72, that our largest truck shelveings of a few years back would carry, to from

117 to 150, which number our large wagons of to-day usually hold. So, you see, in both tons and baskets the loads have almost doubled, and will ere long more than do it, as larger wagons are being ordered.

The cost of keeping the stone roads in repair is very much less than keeping the unimproved roads in repair. We have \$3,000 appropriated for maintenance of roads, and it is generally about all used up, and we think we use it judiciously. I have just finished graveling one-half mile at a cost of \$250, with gravel very handy (this did not include putting the road in shape, attending to drainage, etc.), which was quite a little to keep a road fairly good. On a dirt road this should be done at least once in fifteen years. Say nothing about graveling, I should say the dirt roads cost fully as much as the stone roads per mile each year, for scraping, ditching, etc.

We are graveling a number of our roads—some that we expected to have stoned, but there does not appear to be any likelihood of having them stoned in the near future. I think the stone roads built in the past have cost and are yet costing entirely too much.

Respectfully yours,

THOMAS H. MARTIN.

The following questions and answers thereto have been taken from a letter from John P. Lippencott, supervisor and overseer of the Vincentown, Burlington County, N. J., stone road constructed under the New Jersey State Aid Act:

Questions 1 and 2.—How do you repair your stone road? What kind of material do you use?

Answer.—It depends upon the condition they are in. If rutted, fill the ruts with three-fourths to one and one-half inch stone, then apply some screenings and roll well when not dry.

Question 3.—How do you treat your road when it ravel, that is, when the surface stone becomes loose in dry weather?

Answer.—If gravel can be obtained (not stiff clay) or a good loam, put on about one inch thick and three to four feet wide, then if it ruts much use a scraper occasionally to level in the ruts and keep the gravel or loam well to the middle of the roadbed, but do not scrape hard enough to tear up the road, then follow with the roller.

Question 4.—Give some experience as the result of your treatment.

Answer.—I patched our road with dirt when it raveled and rolled it, using some screenings. When we have a long dry spell it seems almost impossible to do any good to a road unless we use water, which is expensive. I think putting on dirt, such as gravel or loam, is a benefit to the road and also the travel, as horses like it much better. If stiff clay is used, when the road is wet the wheels will lift the stone up with the clay. This will leave holes and uneven places. After dirt is put on a road I think the scraper should be used whenever a ridge appears outside of the ruts and then well rolled is the cheaper way of keeping the road in order. Unless more stone is needed to fill the ruts the dirt naturally works outward.

Question 5.—What is the cost of keeping stone roads in repair, per year, per mile?

Answer.—This question I can not answer exactly, as it depends upon how much the road is traveled. I think by using good gravel or loam the cost is much lessened. The stone dust does not blow away, but unites with the gravel or forms a cement, which packs very quickly. I do not think the cost would be more than \$60 per mile per year for 5 years after the first year, on an average.

Question 6.—How does the cost of repairs of stone roads compare with cost of gravel roads?

Answer.—When we had gravel turnpikes, gravel was very convenient. It cost \$50 to \$75 per mile per year, and then in wet weather and in spring they would be nearly impassable.

Must The Farmer Pay For Good Roads?

By
OTTO DORNER
Milwaukee, Wis.

Chairman
National
Committee for
Highway
Improvement
League of
American
Wheelmen

FIRST EDITION OF 400,000 COPIES

This pamphlet, published by the League of American Wheelmen, is adopted by the United States Department of Agriculture as Circular No. 31 of the Office of Road Inquiry.

ROY STONE,

Director of Road Inquiry.

Approved: JAMES WILSON, Secretary of Agriculture.

THIS book is published by the League of American Wheelmen to give a better understanding of the system of state aid to road building which has been in force in New Jersey for a number of years. It has also been adopted in Connecticut, Pennsylvania and New York. Minnesota has taken steps to amend the constitution for its introduction. Our League advocates state aid because it offers a solution of the good roads problem in the farmer's interest. It is a means by which the cities will help to pay for country roads.

The observations on the importance and value of better country highways, and the suggestions for the improvement of our common roads, are taken from the writings of practical men, the most noted of those who have made a study of these subjects. They are presented with entire confidence in their own inherent reason.

The pictures illustrating the book are all made from photographs, and will help to show the difference between roads as they exist in the United States, and what these same roads might be made to be.

MUST THE FARMER PAY FOR GOOD ROADS?

Aims of the League of American Wheelmen—State Aid—Cities Should Help.

THE trouble about building roads is in having to pay for them. We, of the League of American Wheelmen, know that it will take a great deal of money to macadamize the highways extending throughout the country, and we also know very well that it is unfair to expect the farmers to shoulder the burden of this expense. The average farmer is not to be blamed if a suggestion, that the roads in his town should be radically improved, calls forth a vigorous protest on his part. He has always been responsible for the condition of the roads in his town, and he alone has had to pay the taxes for keeping them up. What wonder, then, that he should believe the proposed radical improvement is to be made at his expense, just like the annual road work?

THE League of American Wheelmen maintains that those who profit by an improvement are the ones who should pay for it. We maintain that every one using a highway should contribute in a proper measure to the cost of its improvement. The farmer is not the only one who uses country roads. They are traveled by the country merchant, the itinerant peddler, the village doctor, the commercial salesman from the city, traveling by team to sell his goods to the cross-roads country store, and, to a greater or lesser extent, by the entire people, not to omit, by any means, the wheelman himself. We feel, therefore, that if our roads are to be improved for the benefit of all these people, they all should bear a share of the taxes necessary to be levied for the purpose. And it should be remembered, too, that the entire city population will

be benefited by the improvement of country roads, not only those who travel them, but all others as well. For, if the farmer, by having better roads, can save in the transportation of his produce, and can afford to sell it cheaper in the city; or, on the other hand, if a saving in its transportation gives him a larger margin of profit on what he sells, with more money to invest in the things supplied by the city, this results in indirect benefits to the city population.

A GREAT injustice has been done the farmers in expecting them alone to shoulder the responsibility and the expense of building country roads, while the construction of canals has been heavily subsidized, while rivers have been made navigable by the government, and while untold



“If the expense for good roads is borne by the state, and not by assessment or direct tax, there are few of the agricultural class but what would gladly support any measure that would gradually insure improved highways.”—American Farmer.

millions have been showered upon railroads, by cities, villages, counties, states and the Nation, in stock and bond subscriptions, cash donations and grants of boundless tracts of public lands. Gen. Roy Stone, Chief of the U. S. Road Inquiry Office, declares: “It is time to do away with the cruel injustice which places upon farmers, and upon the small fraction of property in the state which they own, the entire burden of building highways for

the whole people. The farms of the United States are between one-fourth and one-fifth of the whole property of the country—probably not more than one-fifth—yet that one-fifth is providing the primary highway for transportation for the whole country. In the State of New York, this burden is borne by less than one-tenth of the property of the state; and every measure which the League of American Wheelmen is advocating is in the direction of actually lifting this burden off the farmers' shoulders, instead of saddling a heavier one upon them."

A. B. CHOATE, president of the Minnesota Good Roads Association, who is a member of the National Committee for Highway Improvement, League of American Wheelmen, has emphasized this point by the following statement:

"The exact ratio of value between farm and city property is not known, but more than one-half of the taxable property in Minnesota is in the cities and villages, with a continual tendency, as the state grows older, to increase the value of city property as compared with the value of farm property. In some of the Eastern states the proportion of state taxes paid by the farmers to that paid by the owners of city property is very small indeed. The bearing which this has upon the question of state aid is very apparent, for if the farmers are required to pay taxes on their proportionately very small amount of property to improve the long stretches of country roads, while the city people pay only enough taxes on their great wealth to improve the roads within the city limits, it will be necessary that the road taxes



In the Country.



In the City.



levied upon farm property shall be very much heavier in proportion to the value of that property than the road taxes upon city property.

Without any attempt at accuracy, because the exact proportion is not known, the accompanying cuts show this inequality. With so much money and with much less territory the cities have a very unfair advantage over country districts. The country roads never have been, ought not to be, and never will be improved at the sole expense of the farming property. It is absolutely impossible for the farmers to do it. Since the whole state is interested in

the improvement of all the roads, and since the city people are interested in and anxious to have the country roads improved, it would be fair to levy a tax on all the property in the state for the improvement of the roads. This is what is meant by state aid. It is very similar to the plan now in operation whereby the state contributes to the expense of country schools. The state, you know, does not undertake to conduct the country district schools, but it does say that if any school district shall run a school of a certain character a certain number of months in the year, the state will contribute to the expense."

THE League of American Wheelmen therefore favors the levy of state taxes for road building purposes, because such a tax is levied upon all property and upon all classes of people alike, upon city and country population, so that every tax payer contributes proportionately, according to the amount



"I believe in state aid for road building, but am of the opinion that the towns should bear a part of the burden. Many of our towns have a small valuation and a large mileage of roads. Such towns, unaided, can never build stone roads, and it is folly to advocate them unless state aid is to be provided."

WILLIAM R. SESSIONS,
Secretary Massachusetts State Board of Agriculture.

of property he owns. A fair share of state taxes is collected from capitalists, merchants and manufacturers, the wealthy corporations, railroad, express, insurance, telegraph and telephone companies. They contribute to the maintenance of

state institutions by contributing to state taxes. If a part of the cost of road building were paid out of state taxes, they would thus share in the cost of building roads as well.

IT may be argued that the city tax payers can be made to contribute to the cost of country roads without a state tax; that a county road tax would accomplish the same result. True, but a county tax cannot be expended outside of the county where it is levied. The large cities of the United States should do more than to help support the roads in the county where they are situated. Philadelphia, Boston, Chicago, New York and St. Louis should



“The reform now advocated is a division of the cost of roads between the state, the county and the road district. This is the only road reform proposed which places the expense where it belongs, and relieves the farmer of the excessive load he has been carrying.”—The Northwestern Farmer.

help, to a reasonable extent, to build roads for some considerable distance beyond their own counties. They draw their trade from a large area of country about them, and anything which contributes to the welfare of this territory, helps their material welfare. The same thing is true of all the fifty-eight cities in the United States of 50,000 or more population, and to a greater or less degree, of every town or city. A state road tax would be shared by every

city in the state, according to its size. The larger the city, the larger its share of the tax, and the larger the area to be benefited. A county road tax could never accomplish this result.

STATE taxes for road building purposes are not new in the United States, although now but little in use. In Washington and Massachusetts certain highways are now selected as state roads, and improved at state expense. State road taxes are becoming popular, however, as part of a system of state aid to roads. Connecticut and Rhode Island have such a system of State Aid on a small scale. New York has just adopted a system of State Aid to roads. Pennsylvania provided for State Aid by the Hamilton Road Law, passed early in 1897. New Jersey adopted a system of state aid, several years ago which has deservedly become



“State aid ought to form a part of every system of road management in this country. In Pennsylvania, the taxes paid into the State Treasury come mainly from the corporations, money at interest, licenses and kindred subjects of taxation.”
—John Hamilton, Author of the Hamilton Road Law, Superintendent Pennsylvania Farmers’ Institutes, and President National Association of Farmers’ Institutes Managers.

highly popular, especially in the farming communities. Under this state aid law the cost of building macadamized roads is divided among the state, the county and the adjoining property owners. One advantage of this system exists in the fact that a road is never improved except with the consent of those residing in the vicinity, who are expected to

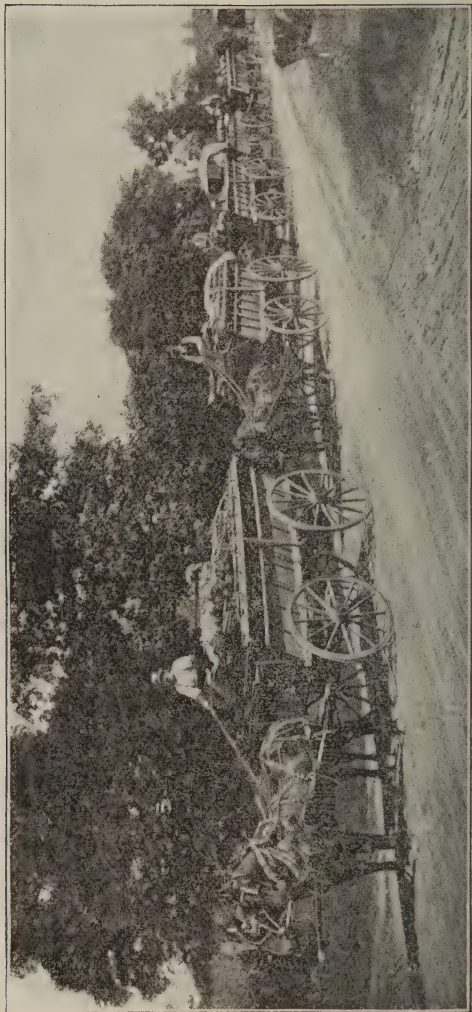
bear a part of its cost. The adjoining property owner pays ten per cent. of the cost, the state pays one third and the county the remainder.

TO get the matter started, a petition is necessary from the owners residing upon the road to be improved; plans are made by a county engineer and submitted to the state highway commissioner for approval. The county makes the contract for the work, and the state appoints an engineer to supervise it. Upon completion of the improvement, a warrant is drawn upon the state treasury for one-third of the cost, properly countersigned by the state engineer, who supervised the work, and the



The kind of roads our Canadian neighbors are building. Picture taken in Hastings County, Ontario.

ten per cent. to be paid by the abutting property owners is collected with the next year's taxes. A division of the cost, like that of the New Jersey state aid system, is right and proper. The state should not be called upon to pay the whole expense. The owners of property along the road improved should pay a share of its cost, because of the increased value of their land resulting from the improvement. The county should pay a liberal share of the expense, because the people of the county furnish the greatest part of the travel. The respective proportion of cost borne by the state, the county and the property owners may be varied in the different states according to the prevailing



A New Jersey road built by state aid.

conditions in each state, but the principle will ever remain the same, that of dividing the cost of road building among all those who are to be benefited, the cities assisting the country districts through the medium of state and county taxes.

STATE aid was first suggested by the farmers of New Jersey, and the necessary laws for its establishment were passed through the combined efforts of the League of American Wheelmen and the farmer organizations. New Jersey's state aid system is justly popular, because it aims to help the improvement of local roads, those used by the farmers, and connecting farm houses with the school, the church, the market town and the railroad station. Any locality in any county in the state may take advantage of the state aid law in its discretion, and owners of property along any given road may petition for its improvement. Without such action on part of the property owners, no improvements can be made under the state aid law. The success of this system appears from the fact that the Highway Commissioner of New Jersey has petitions on file in his office for the improvement of roads requiring many times the appropriations made by the state legislature. New Jersey farmers no longer fear that the cost of improved roads must fall upon them alone, and the greater portion of the Highway Commissioner's time is consumed in listening to the pleadings of farmers from all parts of the state, urging that their roads may be the first to be improved under the state aid law.

ANY policy of road improvement which is not in the farmers' interest is not our policy. This explains the action of the League of American Wheelmen in favoring the introduction of state aid to roads. In advocating such a system of state aid, and the division of the cost of building roads among city and country tax payers, we feel that we are relieving the farmer of the burden of responsibility and taxes for country roads, instead of loading him up with heavier burdens, and that we are also helping to relieve him of the enormous mud tax, caused by poor roads.

WHAT NEW JERSEY FARMERS THINK OF STATE AID.

By H. I. BUDD,
State Commissioner of Public Roads, Trenton, N. J.

The workings of the law for state aid to roads have proved very satisfactory in all localities where the improvements have been made, and the interest in the roads, instead of suffering any abatement, is intensely growing. Opposition to the law on the part of farmers has been changed to so much enthusiasm for it, that 240 miles of good roads have been built, and more roads are being applied for than can be built in many years under the limited State appropriation, so that it becomes quite a problem to select the ones to be first improved. The farmers of many counties are grasping the idea that under the State Aid Law they can easily and economically cover their leading thoroughfares with stone, so no persuasion is now needed to induce farmers to



A New Jersey load of manure. Some of these loads, weighed on the scales, have amounted to 6,869, 7,300 and even 7,920 pounds, clear of the wagon, which weighed alone 2,300 pounds, making a total of four and a half tons.

avail themselves of the state bounty. Though at first they were suspicious of the law for fear it would immeasurably increase their taxes, they have found by experience that it sits but lightly upon them, and is a small expense compared with the saving by the more easy passage of their produce to market, and by the

inducement it offers to the city people to become visitors and locators upon their lands.

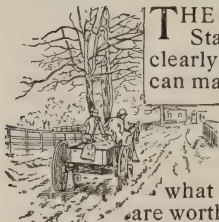
County and state taxes, being assessed in the city as well as in the country, according to the value of property owned, include the wealthy merchants, manufacturers and insurance companies. Most of the wealth of the state being found in the cities, our system successfully provides for the construction of improved roads without laying much of the burden upon the farmers, not requiring them to contribute more than an equitable share of the expense, according to the wealth of each individual tax payer. The farmers' incomes are small compared with those in other pursuits; therefore at first they hesitated to subscribe to the building of these improved highways; but we have demonstrated, by building numerous stone highways under the State Aid Law, that we can have good roads without overloading them with taxes. They are now finding it as easy to go from the country home to the school house, market, lecture room and church as it is for the people to pass from their homes in the



Eighty-five to a hundred baskets of potatoes now make a fair load on the New Jersey stone roads; twenty-five baskets were a good load on the old dirt roads.

city to the same places. Thus they have all the delights of rural existence and the advantages offered by the towns, the daily mail, social intercourse with neighbors, etc. Thus, farmers less favored in the race of fortune are learning that by this method they can obtain these substantial improvements without submitting to an enormous tax. The question of keeping the present generation on the farm by giving them better social advantages through free and easy communication, will probably be solved by this new movement.

THE COST OF HAULING CROPS.



THE condition of roads in the United States, taken as a whole, can most clearly be shown in figures. If we can make inquiries of a hundred farmers, in as many localities, as to how long it takes each of them to haul a load of crops to town, how far he hauls it, and what his time and that of his team are worth, we can readily ascertain what it costs on an average to market a load of crops. If the number of these inquiries be sufficiently increased, and extended over the entire country, the result will pretty nearly show what it costs on an average, in the whole United States, to haul a load of crops to market. If with each inquiry, we also ascertain the weight of the load, we can figure out how much it costs per hundred pounds, or per ton, to market all these crops; and if the inquiry also include the number of miles comprising each haul, we can easily figure the cost of hauling these crops per ton per mile. This gives a unit which can be compared with the same unit, similarly obtained, by similar inquiries made in other countries.

AN inquiry of this kind was made in November, 1895, by the United States Department of Agriculture, through its Office of Road Inquiry. Ten thousand circulars were sent out, to farmers in all parts of the United States, asking for information in these various particulars. Replies were received from over 1,200 counties distributed throughout the United States, and the results were carefully compiled. The weight of loads hauled varied between an average of 2,409 pounds in the Prairie States, and an average of 1,397 pounds in the Cotton States, the average weight of farm loads for the whole country being 2,002 pounds, or practically a ton. The average length of haul was

found to be $12\frac{1}{10}$ miles, varying between $5\frac{9}{10}$ miles in the Eastern States, and $23\frac{3}{10}$ miles in the Pacific and Mountain States. The average cost of marketing a ton of crops in the United States was found to be \$3.02. It was as high as \$5.12 in the Pacific Coast and Mountain States, due to long hauls, and as low as \$1.87 in the Northern and Eastern States, which are more densely settled, and where railroads are numerous and hauls are shorter. The average cost of hauling a ton a dis-



The cost of shipping a bushel of grain today from Chicago to New York is one-fifth of what it was at the close of the war, and the cost of shipping it from New York to Liverpool is only four cents where it used to be ten and one-half cents; but the cost, in time and effort, of man and beast, in hauling wheat from the farm to the railway, has not been reduced in many years.

tance of one mile was 25 cents, it being 22 cents in the Prairie and Pacific Coast and Mountain States, and rising as high as 32 cents in the Eastern States.

THE net grand result of all these inquiries and computations showed very clearly, and as nearly as human intelligence can, that it cost the farmers of the United States, on an average, in time, labor, and energy, figuring the value of teams, wagons and men at what they can reasonably be

hired for, 25 cents, every time a ton of their crops was hauled a mile nearer to market, or, briefly, that it costs 25 cents per ton per mile, to move crops in the United States. This figure, obtained through inquiries made by officials of the United States, is as correct as fair and impartial inquiries can make it, for the government has no



Load of hay in France. After a photograph.

object, in making investigations of this kind, except to ascertain the truth, for the benefit of the people. The detailed results of this investigation are published in circular No. 19 of the Office of Road Inquiry at Washington, which will be mailed upon request.

BY way of comparing the roads of the United States with those of Europe, the Road Inquiry Bureau made careful inquiries abroad, in the winter of 1896-7 through the United States Consuls stationed in England, France, Germany, Belgium, Italy, and Switzerland, as to the average cost of

hauling crops in their various consular districts. It is impossible here to give the result of these inquiries in detail, but they have been published as circular No. 27 of the Road Inquiry Office, and can be had for the asking. The average cost of hauling farm products in England, as reported by our consuls there, is a trifle less than 10 cents per ton per mile. In France it is the same. The consul at Roubaix, in France, reports that hauling is usually done on wagons with wheels $55\frac{1}{2}$ inches in diameter, and having tires of $4\frac{1}{3}$ inches, which prevent cutting up the road. He explains that in his district there are a great many more paved than macadamized roads.

QUITE a number of detailed reports come from various parts of Germany. The average cost of hauling there, as it appears from these reports, is $8\frac{1}{2}$ cents per ton per mile, ranging all the way



Something more than stone is needed in order to make a macadam road. Picture of a road near Swiftwater, New Hampshire.

from 12 and $12\frac{3}{4}$ cents, in the consular districts of Mannheim, Plauen and Frankfort-on-the-Main, to 5 and $4\frac{1}{6}$ cents, in the consular districts of Munich and Hanover. In no reported case in Germany is the average cost higher than $12\frac{3}{4}$ cents per ton per

mile. The consul at Hanover explains that in his district a good team can haul about 6 tons for an all day trip, and that the average load is not much less than that. In the Munich district it is $5\frac{1}{2}$ tons. The United States consul in Belgium reports that farm products are there hauled at a cost of $9\frac{1}{2}$ cents per ton per mile. At Milan, Italy, the cost is $7\frac{1}{2}$ cents, and on the Island of Sicily grain and seeds are hauled at $7\frac{1}{3}$ and $6\frac{1}{4}$ cents per

ton per mile. In Switzerland, a mountainous country, in the district of St. Gall, farm products are hauled for 8 cents per ton per mile, and in the district of Horgen at 6 cents per ton per mile.

ALL these inquiries are made by sworn government officials, with the simple view of ascertaining the facts. They were so made that the results should show the true cost of hauling farm products in Europe. Putting together the figures reported by the various consuls, it appears that European farm products are hauled to market at an average cost of $8\frac{6}{10}$ cents per ton per mile, which is just a trifle more than one third of the



A country road in Italy.

cost of marketing farm products in the United States. The difference is due almost entirely to the different character of roads here and abroad. European roads, as a rule, are built level, where our own roads run over hills and through hollows; roads abroad are carefully and scientifically built of stone, where ours are built of dirt, sand, sod, or "any old thing"—indeed, they are frequently not "built" at all. Where we haul a ton, or three-fourths of a ton, a European farmer generally hauls 3 or 4 tons, in fact loads of $5\frac{1}{2}$ tons are common in some districts, and a load of even 6 tons is not rare.

THE great advantage of macadam roads for hauling farm produce and heavy loads has been strikingly illustrated by Mr. Isaac B. Potter, now the president of the League of American Wheelmen. In the "Gospel of Good Roads," published by Mr. Potter in 1892, and which probably did more than anything else to lay the foundation for the good roads movement on a large scale, he says:



Isaac B. Potter.

"The wagon by which you haul your loads to market bears the same relation to the road that the railroad car bears to the steel track; the car and the wagon are both vehicles, and in the earlier days of railway traffic cars were drawn by horses just as wagons are drawn upon the common roads, and

just as street cars are now drawn in the cities. The ordinary street car, drawn by two horses, weighs 5,000 pounds; the open car used in summer will seat fifty passengers, weighing 7,000 pounds; total 12,000 pounds, or 6 net tons, and this load is drawn by a team at the rate of six miles an hour without difficulty. The wheels of your wagon are made round and true; they turn upon axles as smooth and well lubricated as those of a car; your horses are as good as those employed in the street car service, and you have every facility for moving large loads quickly and cheaply, except the single requirement of a good road. Of course, I do not intend to argue that wagon loads can be hauled upon a high class road as cheaply as upon the steel railroad track, but I have shown you enough to convince you that the ordinary dirt road is in no way fitted for your business, and that a wonderful contrast exists between such a road and the well-made highways of other countries. It may be interesting for you to know that the exact difference in power required to move a given load over different kinds of road surface, has been determined many times, and so often verified as to be well settled. From these experiments you may know that on the smooth surface of a macadam road one horse will haul twice the load that the same horse could haul on the best dirt road, and from five to ten times as much as can be hauled by a single horse when the dirt road is covered with soft mud and ruts. From this you will understand that the value, even of a dirt road, depends very largely upon its condition and the care with which it is kept in good repair."

IN connection with the investigation outlined above, the United States Road Inquiry Office has undertaken to ascertain the total loss from bad roads in the United States. The results obtained were given to the author, in 1895, by Gen. Roy Stone, the Engineer in charge of the Road Inquiry Office, as follows:



Gen. Roy Stone.

“Taking the census returns of the farm products of the United States for 1890, adding eight per cent. for the increase in five years, finding the weight of the various articles and reducing the total to tons of 2,000 pounds, we have a total weight of farm products for the year 1895 of 219,824,227 tons. Comparing the amount by states, Iowa leads with 24,287,000 tons; Illinois comes next with 21,000,000 tons; Kansas with 17,000,000; Missouri, New York, Ohio and Nebraska with from 12,000,000 to 13,000,000 tons each; Indiana and Pennsylvania about 10,000,000 tons each; Michigan, Minnesota and Wisconsin 7,000,000 to 8,000,000 tons each, and Texas, Colorado, Kentucky and Tennessee with 4,000,000 to 5,000,000 tons each. No information is available as to the amount of hay and grain consumed upon the farms where they are raised, nor is there any return of large classes of materials moved over the country roads, among which are building, fencing and road materials, fertilizers, coal, ore and metals, meats, eggs and poultry, straw and fodder, garden products, merchandise of various kinds and farm machinery. It is deemed safe, however, to offset these various items against home consumed hay and grain, and so count the equivalent of the total farm product as being hauled on the public roads. The Chief of Forestry of this Department makes the very safe estimate that 5,750,000,000 cubic feet of lumber mill products and lumber used for fuel are hauled over the public roads; adding timber used for railroad construction, 485,000,000 cubic feet, makes a total of 6,235,000,000, which at 30 pounds per cubic foot gives 93,525,000 tons of 2,000 pounds. Adding this to the total farm products gives 313,349,227 tons, which at the average cost stated, \$3.02 per ton, makes a grand total for the annual cost of haulage on the public roads of \$946,414,665.54. The immensity of this charge will be best realized by comparing it with the values of all farm products in the United States for the year 1890, \$2,460,170,454.” And Gen. Stone writes again

at the present day: "Our information regarding the cost of hauling in foreign countries and in the few good road districts of this country indicates that nearly two-thirds of this total is due to the bad condition of the roads."

JOHN M. STAHL, editor of the "Farmers' Call" and secretary of the Farmers' National Congress, has also investigated the cost of wagon transportation in the United States, and the savings



John M. Stahl.

that would be effected by good roads. His investigations were made in the fall of 1891, and were probably the first inquiries into the subject ever conducted on a large scale. As to the results of these inquiries, Mr. Stahl writes:

"I could find no previous effort that gave me any real aid; there were guesses in abundance, but only guesses. The reports of the Interstate Commerce Com-

mission, and of the Department of Agriculture furnished a basis from which I could work, as well as the bulletins then being issued by the Census Office, covering the railroad, lake and river transportation of the United States, and giving, in detail, the amount of freight of each class. From the various statistics contained in these reports, and estimates based thereon, I was forced to the conclusion that the annual cost of wagon transportation of the country was \$900,000,000, and that if all the road improvement were made that could be made profitably, the annual saving in wagon transportation would be \$500,000,000. These figures were so large, so astounding in fact, that I held them for some months, verifying them as best I could before I made them public. Convinced that they were substantially correct, I used them in an address at the meeting that organized the Illinois Highway Improvement Association, March 30, 1892. That address was published and widely circulated by the League of American Wheelmen. I used these figures in an article in 'Current Topics' for March, 1892, entitled 'How to Save Five Hundred Millions a Year.' The figures were at once stoutly disputed, but they have never been successfully assailed. They have often been quoted in good roads meetings and publications, and have been frequently verified, notably by

the U. S. Office of Road Inquiry. I made the same statements before the Farmers' National Congress in the fall of 1892, at Lincoln, Nebraska. At that meeting the good roads resolution



Road between Princeton and Fitchburg, Mass., before improvement.

introduced by me was debated more than all other resolutions put together, but was finally adopted by a good majority. This was the first time such resolutions were adopted by such a representative agricultural body. The Congress has given its hearty



The same road macadamized.

support to the good roads movement ever since, and is favorably disposed to state aid — the only way in which good roads can be equitably paid for.”

ROADS AND ROAD MACHINERY.



THE first thing to be observed in building country roads is to afford protection against water. A dirt or gravel road properly built and maintained can be made to shed water like a roof, and if the use of narrow tires and the wearing of ruts could be prevented, our country roads might be excellent. Water always runs down hill, and this should be taken advantage of in road building. If the road be properly crowned, that is, if its middle be properly raised above the sides, the rain and melting snow will naturally run off into the ditches. On the other hand, if the middle be worn down by travel, the water collecting there will soon form a puddle, and ruin the road. In the same way, ruts formed by narrow tires afford a trough for the collection of water, and contribute to its destruction.

LABOR as they might, American farmers have long been unable to build their roads so as to shed water. But the solution has been found in the road grader. The American farmer is quick to realize the value of machinery, and the rapid growth in the use of the reaper, the binder, the separator, is an eloquent tribute to the practical genius of American agriculture. The growth of the use of road graders has been wonderful during the last few years, and indicates that the farmer has discovered a practical solution of the problem how to build his local dirt roads.

THE peculiar feature of a road grader is that it cuts away the dirt at the side of the road, and draws it up into the middle, thus producing a ditch at each side and a slope in each direction from the center. At the same time it will cut away the dirt to just the proper depth, and no deeper. In this particular, its work differs from that accomplished by the use of plows, shovels or hand

scrapers. The road grader leaves a smooth, regular surface, giving the road the proper contour. A dirt or gravel road can be put into excellent shape by running the grader repeatedly over it. Care should be taken first to remove brush and rubbish from the side of the road, that the grader may not carry it into the traveled roadway.

TO properly finish a dirt road made with the use of the grader, it should be thoroughly rolled and hardened. It is not sufficient that it be crowned,

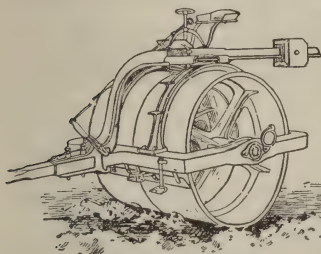


Wm. F. Pierstorff, who saved two-thirds of the town road taxes by the use of machinery.

but it should be made hard and smooth. The same thing is true of gravel roads. This can be best accomplished with the use of rollers. Horse rollers weighing from five to eight tons are most frequently used for the purpose. All loose stones should be removed from the road surface before rolling, as well as sods, turf, leaves, sticks or any other matter that will tend to soften the road bed. A road that is thoroughly and repeatedly rolled is well fitted to stand the wear of travel, and can be made into a perfect watershed.

THE difficulty about the use of road machinery in many localities is to be found in its cost. It is frequently thought wrong that farmers should be obliged to tax themselves for the purchase of road graders and road rollers, in addition to having to stand the regular road tax. There is much justice in this position, for the average farmer pays his full share of taxes, and these should not be added to or increased without some very excellent reason. But the farmers of the United States are badly in want of good roads, and the clamor for their construction is growing from year to year. Quite a number of towns have solved the road machinery problem by voting to pay their taxes in cash instead

of working them out, and using a part of this fund for the purchase of machines, which avoids the necessity of levying an extra tax for the purpose. This plan has been adopted in New York and Wisconsin, and probably elsewhere. The town of



A popular road roller.

North Salem, Westchester Co., New York, adopted it as far back as 1881. The town of Canaan, Columbia Co., New York, adopted it in 1887. In Wisconsin, C. H. Everett, until recently the president of the Wisconsin

Dairymen's Association, says on this subject in a recent letter: "The town of Turtle, Rock County, where I reside, was among the first to adopt the cash system, and has two improved road graders. I do not think that our people could ever be induced to go back to the old system. We know that we have spent enough money in road taxes during the past forty years to have macadamized every road, and until we began to pay our road taxes in cash and use machinery, there had been little or no improvement in our highways."

THE proposition to pay road taxes in cash met with little favor in the beginning. Farmers were unwilling, as might reasonably be expected, to pay their road taxes in cash instead of in work. But sentiment is now largely the other way among intelligent farmers, since experience has shown that more can be accomplished with one dollar of tax paid in cash, than two dollars or even three dollars of tax worked out on the highway. Where the system has been fairly tried, farmers have found it by no means the burden expected, since they may still be hired by the road officers to run the machinery used. Two cases in Wisconsin are instructive on these points. Martin J. O'Malley, chairman of the town of Westport, Dane County,

writes: "We adopted the money system in the town of Westport two years ago. We purchased a good road grader, and we levied a 2-mill road tax instead of the 4-mill tax that we had been paying working the old way. The people are allowed to

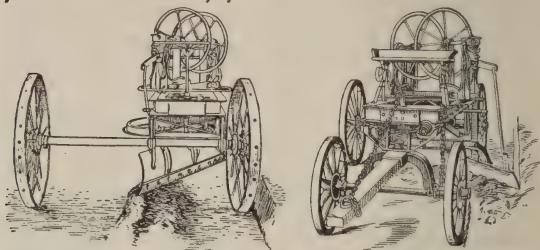


Cross section of a dirt road built with the use of a road grader. The middle is left high, and the whole surface smooth, that rain may run off to the sides.



Cross section of dirt road as frequently left by travel. Note that the water must collect in the tracks left by wheels and horses.

vote on the question at every election, and they are fully convinced that the cash system is the only true way of getting good roads. There has been more work done on our roads during the past two years than in twenty years before."



Front and rear view of road grader at work. The blade with which the scraping is done can be placed in any desired position.

THE same experiment was tried in the town of Middleton in the same county, and with the greatest success. In 1894, under the new law passed the year before, the town paid its road taxes in cash, and used part of the money for the purchase of two road graders. Wm. F. Pierstorff,

chairman of the town, told of their experience in an address delivered at Watertown, in the spring of 1896. "Under the old laws," says Mr. Pierstorff, "we always levied a road tax of 4 to 6 mills. In 1890, a tax of \$2,297.80 was levied; in 1891, \$3,346.70; in 1892, \$2,326.77, and in 1893, \$2,471.93. In 1894, the first year under the new law, we levied 2 mills, amounting to \$1,051.58, and bought two road graders. We gave the farmers a chance in handling graders to work at three dol-



"No class of farmers are more interested in good roads than the dairy farmers. In all kinds of weather, and every morning in the year, must they take their milk to the factory and haul the skim milk back over the same route. Does not the fortune of dairy farmers, as well as their good name, require that they unite for an intelligent building of the roads?"

WILLIAM D. HOARD,

President National Dairy Union and Ex-Governor of Wisconsin.

lars per day with team, they giving us ten hours for a day's work. In 1895 we levied 2 mills as before, and expended \$1,231.56 for our regular work on the highway. You will see that for the last two years we expended for general highway purposes an average of \$1,141.57 a year, while the average for the preceeding four years was \$2,827.28. It is admitted by all that there was more work done in the last two years than the town has ever had done before. You can do more work with three teams and one grader in a day

than with three teams and a small scraper in a week. Our people are well satisfied with the new system, and they will never vote to go back to the old method of working the highway.”

THE state of New Jersey, by act of 1890, made all road taxes payable in cash. This was the beginning of the new road system in that state. This works well and all are satisfied that more and better work is done with less cost than by the old system of working out the road taxes. Many other instances might be cited where it has been found highly profitable to build roads by machinery and to pay road taxes in cash for the purpose. Many towns have adopted such a plan with excellent results. Letters on the subject from a great many town officers have been published by the U. S. Office of Road Inquiry at Washington. These are contained in circulars Nos. 16 and 24, which will be mailed upon request to anyone desiring to study the subject of building dirt roads.

RAILWAY TRACKS ON HIGHWAYS

A GREAT deal of damage is frequently done to improved highways by electric and dummy railway companies, which tear up the roadway for the laying of tracks without properly repairing it. Railways of this kind ought to be built upon private property; they do not belong upon public highways which have been improved at great expense, and both the tracks and cars are often very much of a nuisance to teams. Where a franchise is granted for the laying of tracks upon a public road, it should not only provide that the railway company shall properly restore and maintain the highway, but should be so drawn as to make it possible to enforce this provision by suitable penalties and forfeitures. It might be made a condition of the franchise that no cars shall be run until the roadway has been repaired to the satisfaction of the town officers, and their approval obtained in writing. Franchises are generally sought on a main road, the travel on which has largely increased as the result of its improvement.

BUILDING MACADAM ROADS.

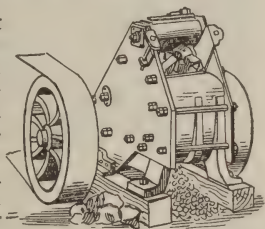


John L. Macadam.

THE ever increasing demand for better highways has led to numerous attempts, which are being made all over the country, to build what are supposed to be "macadam roads." They are mentioned in the county budgets as well as in resolutions for the improvement of city streets, and the indulgent taxpayer, when his eye falls on the high-

sounding name, takes satisfaction in the idea that he is now to have highways of the most modern type. But, alas, the attempts to build stone roads are rarely successful, for, while much excellent material is often employed, the methods adopted are generally deplorable. In too many cases the men having the work in charge are content to simply deposit the stone upon the highway, frequently throwing it right into a muddy spot, and doing nothing further after the material has been put in place and spread. In many of the towns and cities where a road roller can be afforded, the officials undertake to finish their work by placing a layer of dirt or gravel on top of the stone, and then running the roller back and forth over the surface until it seems to be hardened.

ALL these attempts at building macadam roads are failures, when regarded from the standpoint of intelligent and scientific road construction. To build a macadam road, the material should be put down in layers, and each layer separately rolled and



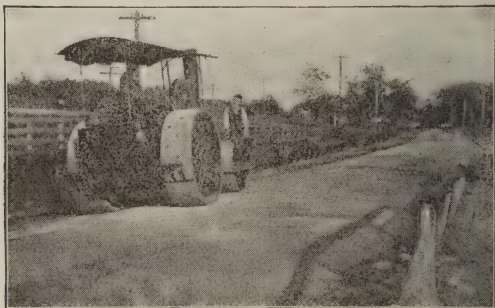
A stone crusher.

compacted. To begin with, the subsoil, which is to serve as a foundation for the stone, must be properly crowned, sloping down from the middle to each side of the road, and then it must be rolled until it is absolutely hard. A soft earth bottom



Spreading stone for a macadam road in Massachusetts.

cannot support a stone roadway intended for ordinary heavy travel. Where a road is built upon low ground, it should be drained. Water finding its



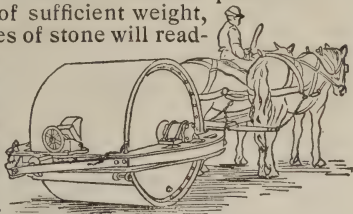
Steam road roller at work.

way beneath a macadam road, unless quickly removed by drainage, will soon ruin it. The stone used in each layer should be of uniform size, as near as practical. Unless the stone to be used

has been properly broken, the road can hardly be a success. No stone larger than $2\frac{1}{2}$ inches should be used. If the bed of stone, when compacted, is to be more than 4 inches thick, it should be put down in two layers, the material for the upper layer to be smaller than that used below, say not larger than $1\frac{1}{2}$ inches. Broken stone may readily be assorted by a rotary screen furnished with the stone crusher.

A COMMON mistake is to spread gravel or dirt over a layer of stone before it is rolled, in the belief that this will help to compact it. The stone alone should be rolled. Under the pressure of a suitable roller, of sufficient weight,

the angular pieces of stone will readily shift about until they are firmly wedged in place, while the round particles of gravel, or the smaller pieces, loose, soft dirt or sand, when mixed



A road roller.

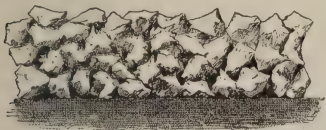
with these angular pieces, will prevent their being thus crowded together and compacted. A layer of very small stone, or screening, or fine gravel, may be used in a separate layer on the surface after the rolling of the layers beneath is entirely completed. This will also fill the few remaining crevices at the top. The surface of the finished road should then again be rolled to make it thoroughly hard and smooth, so that the rain and surface water will readily run off to the sides. If this water should penetrate into the road, it is liable to soften the foundations. Water is the greatest enemy of good roads.

THE above explanations are the result of a careful study of the instructions issued by the state highway commissions of Massachusetts, California, New Jersey and Connecticut, and indicate the principles followed in those states in the construction of roads by state aid. The same principles are set forth in treatises upon macadam roads as



Macadamized Road near Camden, N. C. Where formerly two bales of cotton made a good load on the old dirt roads for two mules, in fairly good weather, the same two mules can now haul ten bales of cotton, on the macadamized roads, in any kind of weather.

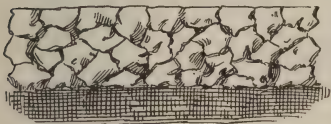
built in Pennsylvania, Alabama, New York, North Carolina and Ontario, and they constitute the fundamental rules laid down by experienced road engineers all over the world.



Stone on a macadam road as it appears when spread ready for rolling.



Stone on a macadam road when partially rolled, showing how the roller packs it.

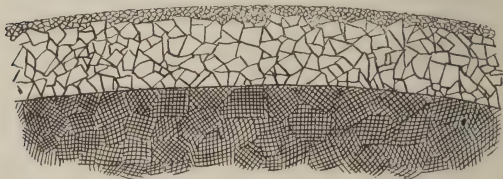


Stone on a macadam road, firmly wedged and packed together. Small stones, gravel, dirt, or sand if mixed with the stone or spread at the surface before rolling, prevent its being thoroughly wedged and packed.

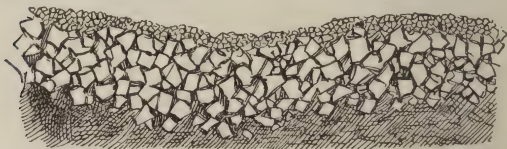
A MACADAM road, when once it is properly constructed, needs but little repairing, and lasts for generations, as has been indisputably and repeatedly proven in England and on the European continent. A stone road, poorly built for want of successful rolling, even with excellent material, can be but a poor highway at best. Many so-called macadam roads, recently built by inexperienced men, or without the proper use of good road rollers, are continually going

to pieces by the wearing of ruts and the subsequent combined action of water and travel. A heavily loaded wagon, with its entire weight resting upon four narrow tired wheels, exerts a tremendous pressure upon a small space, far greater than that exerted by the broad surface of the road roller. Every wagon wheel has a great tendency to displace the particles of road material, by crowding them both downward and sideward. Hence the necessity of exercising the greatest pains and the utmost care in thoroughly packing, rolling, and hardening any macadam road.

THE building of macadam roads offers opportunities for manifold mistakes and for an enormous waste of public funds. If ever it be true that what is worth doing at all is worth doing well, it is emphatically true in the building of stone roads. If a macadam road cannot be built right from the



A good foundation is necessary for a good macadam road. Both the foundation and the finished macadam roadway should be "crowned," or made higher in the middle than at the sides.



The mistake is often made of depositing macadam stone on an old road, without first preparing a suitable foundation. This picture shows how the dirt or mud prevents the stone from becoming properly packed. The almost certain result is that the stone will continue to sink as the result of travel, while the mud oozes out at the top, leaving the road nearly as bad as before.

start, it had better not be built at all, to prevent a needless waste of money. Every good macadam road testifies to the value of durable highways, while every stone road improperly built throws a shadow of doubt upon the movement for better roads.

NOTE: A very complete treatise on the construction of macadam roads, 72 pages, profusely illustrated, is published by the League of American Wheelmen, and will be sent to any address by the author on receipt of a two cent stamp. The book is from the able pen of Mr. Isaac B. Potter, now the President of the L. A. W., who is an engineer of experience, and has made a study of road building for many years.

IMPORTANCE OF WIDE TIRES.



IT is frequently claimed that roads in the United States, instead of getting better, are constantly getting worse, and when the reason is asked, the explanation is made that the damage done to existing highways by the use of narrow tires is far greater than the improvement made by the semi-annual effort at fixing the roads. Without entering into a discussion of this claim, there is no denying that a heavily loaded wagon with narrow tires leaves its tracks on the highway, and the depth of these tracks depends upon the character of material of which the road is built, the width of the tires and the weight of the load. Whenever a loaded wagon becomes stuck, it is due to the fact that the road is too soft, and the tires too narrow for the load on the wheels. Water and narrow tires are the two causes which contribute to ruin the best roads. They aid each other in the work of destruction. The rut formed by a passing wagon forms a trough for the rain, which, instead of running off to the side, as it would do on a hard, smooth surface, sinks into the ground. The next wagon, finding the ground softened, digs its wheels deeper into the surface, and so the demoralization and destruction continues. This suggests one of the strongest arguments in favor of the use of wide tires. Wide tires are road makers, narrow tires are road destroyers. Wide tires roll and harden the road surface, and by their use every loaded wagon can be turned into an effective road roller. Every wagon which today helps to cut up the roads could be utilized for their improvement, for nothing so much tends to the making of good roads as continual rolling of the surface.

ONONDAGA County, New York, furnishes an interesting illustration of the value of wide tires as road rollers. The Solvay Process Company, of Geddes, in that county, were accustomed

to hauling heavy loads of stone for four and a half miles from the quarry. To test the wide tire theory, they built several wagons having 4-inch tires on the front wheels and 6-inch tires on the rear wheels, and with the rear axles longer than the others, so that the track of the rear wheels would just lap outside of those made by the others. The



Wisconsin has all kinds of roads. This is one kind. Picture taken between Winneconne and Poyssippi.

result of the use of these wagons was to produce a hard, smooth, compact surface, and the road, having been filled so as to raise the middle, or "crown" it, is thoroughly drained at the surface, and always fit for use with the heaviest loads. Loads of 8 tons are frequently hauled over them, and instead of tending to cut up the road, serve to roll it harder and harder. The superintendent reports, too, that the improved condition of the road has reduced the cost of hauling the stone from 80 cents per ton to 60 cents, or 25 per cent.

IT has also been proven by experiments upon a number of occasions that the use of wide tires considerably reduces the amount of power required to move loaded wagons. One of these tests was made by the officers of the U. S. Department of Agriculture at the Atlanta Exposition in 1895.

Two wagons, both weighing alike with their loads, were drawn over a wet piece of clay road, one wagon having 2-inch tires, the other with 4-inch tires and with the rear wheels farther apart than the front wheels, so as not to run in the same track. It was found by the use of the tractometer, an instrument made to register the power exerted, that twice as much pull was required to haul the

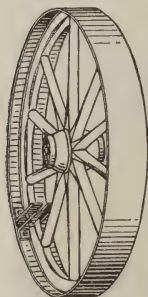


Narrow tires and water are the two great enemies of good roads. Picture taken in Wood County, Ohio.

2-inch tired wagon as was required for the other. That part of the road traversed by the narrow tired wagon was cut and rutted to a depth of several inches, while the tires of the other wagon had rolled the road into a smooth and hard surface.

THE Missouri Agricultural Experiment Station made a series of tests extending from January, 1896, to September, 1897, in order to thoroughly and scientifically ascertain the value of wide tires as compared with narrow ones. They were made with two wagons, one with 6-inch tires, the other with standard $1\frac{1}{2}$ -inch tires, both wagons of the same weight, and each loaded with 2,000 pounds. It was found that the same power needed to draw the narrow tired wagon, with its 2,000

pound load, on a gravel road, would have pulled a load of 2,482 pounds on the wide tired wagon. The same power required to draw the 2,000 pound load on narrow tires over dirt and gravel roads when these were dry and hard, was found sufficient to draw a 2,530 pound load on the wide tired wagon under the same conditions; and it was



A wide tire which may be clamped on your old wagon.

shown that when these roads were deep with mud, but partly dried at the surface by a few hours' sun, the same power required to draw the 2,000 pound load over them on the narrow tires, would pull a load of 3,200 pounds on the wide tires. Director Waters, of the Station, states that the conditions under which the narrow tires offer an advantage over the wide ones, are "unusual, and of short duration," and that "through a majority of days in the year, and at times when the dirt roads are most used, and when their use is most imperative, the broad tired wagon will pull materially lighter than the narrow tired wagons." He states that "a large number of tests on meadows, pastures, stubble land, corn ground, and plowed ground in every condition, from dry, hard and firm to very wet and soft, show without a single exception a large difference in draft in favor of the broad tires. This difference ranged from 17 to 120 per cent." As a result of all experiments conducted, he says "it appears that six inches is the best width of tire for a combination farm and road wagon, and that both axles should be the same length, so that the front and hind wheels will run in the same track."

EXPERIMENTS made at the Agricultural Experiment Station in Utah have demonstrated that a 1½-inch tired wagon drew about 40 per cent. heavier than one with 3-inch tires, and weighing, with its load, the same as the other. At the Ohio State University it was shown that a wagon with 3-inch tires and loaded with 4,480 pounds, could easily be hauled by two horses over an ordinary

dirt road in good condition and with a hard surface, while with a narrow tire half as much was a full load for a double team.

THE principle of wide tires is so generally acknowledged in Europe that laws have been passed in each country prescribing their use. Austria requires tires of at least $4\frac{1}{3}$ inches width, increasing as the load to be carried rises above $3\frac{1}{2}$



If all hauling were done on wide tired wagons, driving to town would be a pleasure instead of the hardship we frequently find it. —A road near West Chester, Pa.

tons. In France, all freighting and market wagons are turned into road rollers by being required to have tires from 3 to 10 inches wide. Germany requires 4-inch tires for all wagons used for heavy loads, and Switzerland requires that they shall be provided with tires of six inches. These regulations have been adopted for the protection of the high class European roads built during the present century.

NOTE: Ruts will not be formed if horses are attached to the wagon properly. The double tree should be long enough to cause the horses to walk directly in front of the wheels. A horse will not walk in a rut, and hence the wheels will not run in the tracks of the last wagon. This keeps the roadway comparatively smooth, particularly when wide tires are used, and any stones loosened by the horses' feet are rolled down by the wide tires following the horses. This is the Pennsylvania system for protecting turnpike roads.

GOOD WORDS FROM GOOD MEN.

FRANK S. BLACK, Governor of New York.

"I appreciate the work done by the League of American Wheelmen in behalf of good roads, and am in full sympathy with their work. The rough and neglected condition of the roads of this state has been the cause of severe and just condemnation."



SEC'Y WILSON.

JAMES WILSON, Secretary of Agriculture.

"I am heartily in sympathy with the movement for good roads and wish the League of American Wheelmen the success its very commendable efforts deserve."

DAN J. JONES, Governor of Arkansas.

"I trust that your organization will continue its agitation of the matter of good roads, which is not appreciated by the great body of American people as it should be. I shall be glad to assist your organization in this movement in Arkansas whenever I can do so."



GOV. BUSHNELL.

ASA S. BUSHNELL, Governor of Ohio.

"Permit me to express my sincere and hearty sympathy in the cause of good roads, which the League of American Wheelmen so earnestly advocates, and which is for the benefit of all."

WM. B. ALLISON, U. S. Senator from Iowa.

"I am very much gratified that you are extending this work into every state, as I think there is nothing now so much needed as good country roads."



EX-VICE PRES.
MORTON.

LEVI P. MORTON, Ex-Vice-President of the United States.

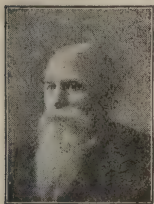
"I am in hearty sympathy with the objects of the League of American Wheelmen, particularly the improvement of the common roads of the country, and send best wishes for the success of the movement inaugurated by your association."

W. D. BLOXAM, Governor of Florida.

"The success of the League of American Wheelmen in its efforts for good roads will be the success of every progressive interest in the land."

EDWARD SCOFIELD, Governor of Wisconsin.

"I am deeply interested in road improvement, and believe the League of American Wheelmen is doing much by its agitation to call attention to the great loss which the farmers, especially, suffer each year through the bad condition of their highways."



EX-SEC'Y RUSK.

The late **JEREMIAH M. RUSK**, the first Secretary of Agriculture.

"I congratulate you very warmly upon the success you have so far achieved in your efforts to organize a concerted movement in favor of this, a much needed reform. It would give me pleasure to do anything in my power to abate the present unsatisfactory condition of our American highways."



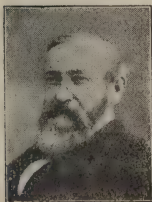
EX-VICE PRES.
STEVENSON.

ALVA ADAMS, Governor of Colorado.

"Accept my assurance of sympathy in any movement that has for its ultimate end the improvement and building of good roads."

ADLAI E. STEVENSON, Ex-Vice-President of United States.

"I am in full sympathy with the efforts now being made to secure good roads throughout the country. It is a gratifying fact that this subject is now undergoing thorough discussion."



EX-PRES. HARRISON.

CHARLES H. GROSVENOR, U. S. Congressman from Ohio.

"There is no subject of greater importance to the local constituencies of our country than the improvement of the roads and highways. The effort for the improvement of roads ought to be quadrupled."

BENJAMIN HARRISON, Ex-President of the United States.

"I am in thorough sympathy with the good roads movement."

CHARLES F. MANDERSON, former Senator from Nebraska and President U. S. Senate.

"I wish your movement every possible success, and I hope that you will sound the cry of 'better roads' throughout the length and breadth of the land."

KNUTE NELSON, U. S. Senator from Minnesota.

"The enterprise you are engaged in is one of the great civilizers of the age, and I trust that you may meet with that success which your earnest and systematic efforts are clearly entitled to."

DAVID M. CLOUGH, Governor of Minnesota.

"I would recommend the adoption of some system of county roads and limited state aid."

SILAS A. HOLCOMB, Governor of Nebraska.

"The League of American Wheelmen has my full sympathy and best wishes for success in its grand work of reform along the lines of good roads."



SEN. QUAY.

M. S. QUAY, U. S. Senator from Pennsylvania.

"I am in hearty sympathy with the League of American Wheelmen in its efforts in behalf of good roads, and believe that the movement must be successful."

JOHN W. LEEDY, Governor of Kansas.

"The League of American Wheelmen and the farmers of this country ought to join hands in a movement directed towards the improvement of our public highways. The active interest of the L. A. W. in that direction is to be highly commended."



SEN. THURSTON.

JOHN T. THURSTON, U. S. Senator from Nebraska.

"I am heartily with the League of American Wheelmen in the movement for good roads. I believe they are engaged in the promotion of a worthy public enterprise, and shall be glad at any and all times to co-operate with them."

GEO. W. ATKINSON, Governor of West Virginia.

"You have my sympathy in your efforts to secure good roads throughout the country, and I wish you God speed in your undertaking."

ELISHA DYER, Governor of Rhode Island.

"The question of improved highways has ceased to be one that can be disregarded. The state is indebted to the Rhode Island Division of the League of American Wheelmen for most valuable financial assistance and earnest support in bringing the matter before the people."

FROM THE FARMER GOVERNOR.

“I am glad that the League of American Wheelmen are pressing the claims for highway improvement. The railroad system of the United States is perhaps the best in the world, but our highways do not compare favorably with the highways of Europe. It is true, this country is comparatively new, but with the push and progress of the American nation, our roads should not long remain in their present condition. Progressive men everywhere should put forth every energy to secure better highways throughout our land. The League of American Wheelmen is destined to become a great factor in highway improvement in the United States.”

JAMES A. MOUNT,

Governor of Indiana.

A STRONG GRANGER VOICE.

“You cannot help agriculture without helping all other interests. As it is now, the farmer bears all the expense of ‘working the roads.’ The business man in the village and city suffers from bad roads and mud as well as the farmer. Then why should not the dweller in town meet the farmer half way? And if all are interested, why should not all help pay for the good roads, which will mean not only greater success to the farmer, but to all others? I hold that as roads are for the public use, the use of all citizens, all should bear the expense of their maintenance, and taxes for road purposes should largely, if not all, be borne by the state.”

MORTIMER WHITEHEAD,

Past Lecturer,

National Grange of the Patrons of Husbandry.



Membership
102,520

704 Enconced, number 31
32
CIRCULAR No. 31.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

WASHINGTON, D. C., *July 23, 1898.*

SIR:

I have the honor to transmit herewith an important paper, by Mr. A. B. Choate, a member of the Executive Committee of the Minnesota State Good Roads Association, on State Aid to Road Building in Minnesota.

Mr. Choate's scheme of legislation is quite similar to that now in vogue in the States of New Jersey, Massachusetts, and New York, and, together with the letters from representative men, contains so many valuable suggestions that I would recommend its publication as Circular No. 31 of this office for the benefit of Minnesota and other States seeking information on this subject.

Very respectfully,

MAURICE O. ELDRIDGE,
Acting Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

STATE AID TO ROAD BUILDING IN MINNESOTA.

By A. B. CHOATE.

AN INJUSTICE TO FARMERS.

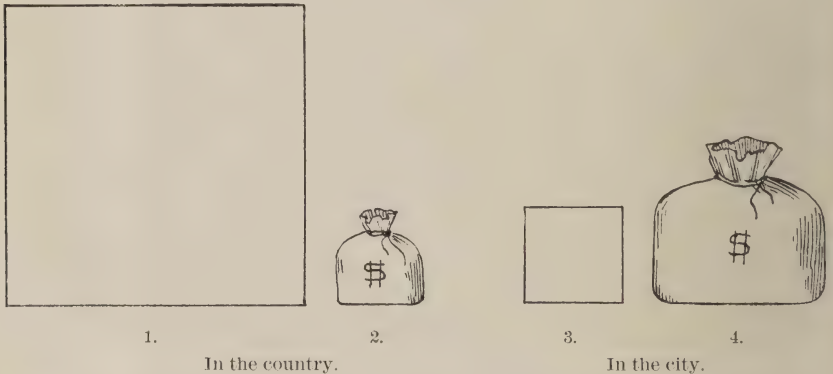
After years of agitation and condemnation of the farmers for failure to build good country roads, the agitators have discovered that they have been trying to work an injustice upon the farmers. The mistake was not in demanding good roads, but in asking the farmers to build good country roads without taxing city property to help pay for them.

TAXATION SHOULD BE EQUAL.

The constitution of this State requires that all property in this State shall pay taxes equally according to its cash value. This is a familiar principle of taxation among the farmers, for we frequently hear them compare the amount of taxes they are required to pay with the amount their neighbors pay, and if a farmer learns that a neighbor is not required to pay as much tax on a farm equal in value to his own, he very properly makes a kick about it. But while this simple comparison is of frequent occurrence, some other comparisons equally important are not made.

TAXABLE PROPERTY MOSTLY IN CITIES.

The tax-paying property of Minnesota, like most States, consists chiefly of farm and city property. The exact ratio of value between the two is not known, but more than one-half of the taxable property in Minnesota is in the cities and villages, with a continual tendency, as the State grows older, to increase the value of city property as compared with the value of farm property. So great is this tendency throughout the United States generally, that in some of the Eastern States where large cities have grown up, the ratio of taxes paid by farmers to that paid by the owners of city property is very small indeed. In New York State, for instance, the farmers pay but one-seventh of the State taxes. The bearing which this fact has upon the question of State aid for building country wagon roads is very apparent, for, if the farmers are required to pay taxes on their proportionately very small amount of property to improve the long stretches of country roads, while the city people pay only enough taxes on their great wealth to improve the roads within the city limits, it will be necessary that the road taxes levied upon the farm property shall be very much heavier in proportion to the value of that property than the road taxes upon city property, and the principle of equal taxation required by our constitution will be violated.



Without any pretension to accuracy, because the exact proportion between city and country is not known and is continually changing, as already stated, this inequality may be illustrated by the above figures. Let fig. 1 represent the long stretches of country roads and fig. 2 the value of taxable country property. Then let fig. 3 represent the streets within city limits and fig. 4 the large amount of city wealth taxable to improve city streets. It is easy to see that the burden of taxation to improve the streets of the cities must be very light as compared with the burden of taxation which will be necessary to make equally good roads in the country, provided the city

property is to be taxed for none but city roads and the farming property must pay taxes for improving all the country roads. It is absolutely impossible for the farmers to do it. With this state of affairs, is it any wonder that the cities have better roads than the country districts? With so much more money and with so much less territory, the cities have a very unfair advantage over the country districts. The country roads never have been, ought not to be, and never will be improved at the sole expense of the farming property.

STATE AID MEANS EQUAL TAXATION.

Now, the business men in the cities have learned that it is to their interest to have better country roads, and they have been scolding the farmers because they have not been building better roads. The



“With so much money and so much less territory, is it any wonder that the cities have better roads than the country districts?”

farmers very properly answer that they can not afford to improve so many miles of road with their small means. As a result the idea has occurred to some that, since the whole State is interested in the improvement of all the roads, and since the city people are anxious to have the country roads improved and are insisting that they shall be improved, it would be fair to levy a tax on city property as well as country property for the improvement of country roads. This is what is meant by State aid. In plain, blunt language, State aid means to the city people, “either put up or shut up.”

CONSTITUTION PREVENTS EQUAL TAXATION.

But when it was proposed to levy a tax on all the property in the State for building country wagon roads, it was found that the constitution of this State forbids the State from raising money by taxation to build wagon roads. It seemed rather strange that the constitution should in one place say that taxes should be equal, and in another place have a provision that makes it impossible to improve country roads without unequal taxation. So, an amendment to the constitution was proposed at the last session of the legislature in a bill introduced by Mr. Douglass of Clay county, which became chapter 333 of the laws of 1897.

WHAT THE AMENDMENT PROVIDES.

This amendment provides for State aid according to a plan similar to that which was adopted several years ago in New Jersey, where it has proven very satisfactory indeed. By this proposed amendment the legislature is authorized to establish a State road and bridge fund and provide for a State highway commission, whose members must serve without compensation, and which shall have general supervision of the expenditure of the State road and bridge fund. This amendment does not contemplate that the State shall actually construct any wagon roads, but that it shall contribute not to exceed one third of the cost of any road, the other two-thirds to be paid by the locality where the road is built. The actual construction of the road so built is to be under the immediate supervision of the local authorities, the State commission simply determining, in a general way, what the character of the road shall be and requiring, before the State pays any money for the improvement, that the road shall be constructed according to plans which it has approved.

HOW STATE FUNDS ARE TO BE RAISED.

The State road and bridge fund authorized by this amendment is to consist of the income of the present internal improvement fund, and a tax not exceeding one-twentieth of one mill upon all of the taxable property of the State. In order to understand this reference to the internal improvement fund, you must know that while our constitution forbids the legislature from levying a tax for building roads, it further provides that if any one is good enough to give the State something for improvements, the legislature may see that the gift is spent for the purpose intended. Now, the United States did give Minnesota 500,000 acres of land for State improvements, and the interest on the money secured from the sale of this land is called an "Internal Improvement Land Fund." This fund has heretofore

been expended for various purposes, and a part of it every year has been parceled out to different parts of the State for bridges. But the distribution of the part that has been used for bridges has been in haphazard fashion and not upon any principle of equal distribution. The member of the legislature who has the strongest "pull" usually gets the most money. It also frequently happens that this fund is used dangerously like a corruption fund, members of the legislature being induced to vote for legislation which they would not otherwise support in return for appropriations for bridges in their particular localities.



"The farmers very properly answer that they can not afford to improve so many miles of road with their small means."

NOTHING NEW IN PRINCIPLE.

So far then as the appropriation of this internal improvement fund is concerned, there is nothing new in principle, but simply a getting rid of this unbusiness-like and dangerous method of distribution, and securing for the wagon roads all of the internal improvement fund instead of a part of it, and distributing it equally and systematically throughout the State. In fact, there is nothing new whatever in principle in any of the provisions of the amendment. Levying a tax equal to one-twentieth of one mill, and applying that to country roads, involves the same principle as that upon which the State now

contributes to the support of the country schools. The State does not undertake to conduct the country district schools, but it does say that, if any school district shall run a school of a certain character a certain number of months in the year, it will contribute to the expense. The State aid proposition, then, under this amendment, is an application to building country roads of the practice now in operation for running country schools.

METHOD OF DISTRIBUTION.

The manner of distribution is briefly this: Not to exceed 3 per cent, nor less than one-half of 1 per cent of the State road and bridge fund expended in any one year can, by this proposed amendment, be expended in any one county of the State. Whenever the people of any county desire a portion of this fund, they may secure, not to exceed 3 per cent, by entering into an agreement with the State authorities to build a road according to certain general directions, provided that the State shall not contribute to exceed one-third the cost of the road. The poorest county in the State can secure its share, and cannot be deprived of its share if it shall comply with the provisions for securing the appropriation.

THE AMENDMENT MIGHT BE IMPROVED.

This amendment is not all that we might wish it to be, because so many members of the legislature did not understand the matter. Few of them had ever given the question any thought and were afraid to make the amendment to the constitution what it should be. They, therefore, limited the State tax for this road fund to one-twentieth of 1 mill. As soon as the people of this State learn what a good thing State aid is, they will want a larger State tax levied in order to get a larger proportion of the city wealth distributed for country road building, and they will then require another amendment to the constitution, allowing a greater tax.

Then, again, the amendment provides that the men who are to have charge of the expenditure of this State road money shall work for nothing. This is wrong. If the commission is needed to oversee the expenditure of this money, the members should not be asked to work for nothing, and if it is not needed it should not be appointed. The State pays its employees in other kinds of work and ought to do so in this work, if it is needed. Probably someone will be found who will be kind enough to work for nothing until the members of the legislature learn more about this subject and then they will probably submit another amendment on that point. But it is best to take what we can get in the right direction, and wait for what we ought to have, on the principle that "a half a loaf is better than no bread."

YOU CAN VOTE FOR STATE AID THIS FALL.

The voters of the State of Minnesota will be called upon to adopt or reject this amendment at the next State election, and so far as known the sentiment is almost unanimously in favor of the amendment, and any who are opposed are probably not fully informed upon the subject. The interest in the subject of State aid is widespread and popular in all parts of the United States, and is being put in form of legislation as fast as the members of the legislatures are made to understand its fairness and advantages. In order to show the sentiment upon this question, we have printed herewith the opin-



“Good roads are a prime necessity, and State aid ought to do much to encourage local districts in building them.”—Hon. William F. Coe, representative Twenty-first legislative district.

ions of a few representative men, and no doubt these men express the sentiment of an overwhelming majority of the most thoughtful and progressive men of the State. In fact there was only one man asked for an opinion who was not favorable to it.

RECAPITULATION.

1. Our State constitution says that all taxes should be equal.
2. Taxing farm property to improve all country roads, and city property to improve only city roads, results in unequal taxation.
3. But our constitution prohibits a State tax for improving country wagon roads, and therefore requires unequal taxation, and should be amended.

4. The city people are anxious to have the country roads improved, because they have a financial interest in their improvement, and equal and just taxation would require them to contribute to the expense.

5. State aid simply requires all benefited property owners to contribute to the expense of road improvements which benefit them.

6. State aid for building wagon roads is upon the same principle as State aid for public schools, and is, therefore, not new in principle.

7. Neither is State aid new as applied to road improvement, for it has been tried successfully in New Jersey, Mrssachusetts, and elsewhere.



"We certainly will never have permanent roads unless it be under State aid, and I hope that the proposed amendment to the constitution in relation to country roads will be adopted, so as to enable the legislature to pass laws giving the different counties some State assistance. It is not just that each country district should bear all the burden."—Aug. J. Anderson, member of legislature, Fergus Falls, Minn.

OPINIONS OF PROMINENT MEN.

Hon. W. B. Douglas, Moorhead, Minn. :

The proposed plan for State aid is thought to be practical and a marked improvement over the existing method of using State aid in highway improvements.

The use annually under the direction of a State highway commission of a permanent road and bridge fund in every county in the State which appropriates a double amount for the same purpose, will operate to complete some particular road every year, and in a few years the improvement should be very noticeable throughout the State.

In the past, State aid has been distributed without any system and unfairly, while such counties as have received it frequently subdivided the fund and parceled it out in dribblets to the different townships, with the result that its effect on our highways has not been felt.

William Danforth, civil engineer, Red Wing, Minn. :

It is my opinion that our main roads will be greatly improved if the proposed amendment becomes a law, and that with a very light tax on the general public.

Hon. R. T. McNeil, member of legislature, Alexandria, Minn. :

I think that everybody should vote for the constitutional amendment at the next election, as it is a move in the right direction and will give better roads at less expense.

Henry G. Hicks, ex-judge of district court—thrice member of legislature :

I think the proposed amendment to our State constitution, providing for a State highway commission and a State road and bridge fund is a step in the right direction; one which will give us better highways in sparsely settled districts throughout the State generally.

O. H. Case, civil engineer, Fountain, Minn. :

Mr. Douglass' bill was a move in the right direction toward "good roads;" and I hope the amendment will receive a rousing majority. State supervision, with a general plan of work, will do wonders, while now our methods are a waste of time and muscle.

Hon. C. A. Parker, member of legislature, St. Paul, Minn. :

I do not wholly agree with the plan designated. I am, however, in favor of the amendment, as it is the best thing offered at the present time. Will do all I can to secure the passage of the proposed amendment at our next general election.

Hon. H. C. Head, member of legislature, Princeton, Minn. :

The proposed amendment to be voted upon in November is, in my judgment, just what is needed to settle and build up our State.

Hon. Wm. T. Coe, representative thirty-first legislative district :

Good roads are a prime necessity and State aid ought to do much to encourage local districts in building them.

W. M. Hays, professor of agriculture in agricultural experiment station, St. Anthony Park, Minn. :

With the modest State fund provided for in the amendment, the State can encourage counties by helping them build some sensible roads adapted to prevailing conditions. It will also encourage the best men found in road work to become experts in road-making. It will have an influence in checking the use of money and labor in ways which result only in poor roads and disgusted taxpayers. While this bill provides State funds for country roads, towns-people generally favor it. Under this law graded dirt roads and bridges will doubtless be the first concern, graveled surfaces will come next, and, in a few of the richer counties, stone surfaces and other expensive roads may be made as samples. This bill will not injure nor antagonize any one but will greatly help the entire State.

Hon. S. A. Stockwell, member of legislature, Minneapolis, Minn. :

I gave my most cordial support to the "good roads" movement in the last legislature, and I hope to see the proposed constitutional amendment adopted, for many reasons, as one of the most important public needs at the present time is good country roads.

O. L. Hamery, civil engineer, Crookston, Minn. :

In my opinion it is a step in the right direction, and undoubtedly next November the voters of Minnesota will gladly accept the same.

W. R. Hoag, professor of civil engineering, University of Minnesota :

The Douglas bill puts the State at once in the attitude of a powerful leader. To enter upon the execution of the provisions of the proposed amendment will usher in at once a season of good road building.

Hon. Augustus J. Anderson, member of legislature, Fergus Falls, Minn. :

We certainly never will have permanent roads unless it be under State aid, and I hope that the proposed amendment to the constitution in relation to country roads will be adopted, so as to enable the legislature to pass laws giving the different counties some State assistance. It is not just that each country district should bear all the burden. We must have a State permanent road fund, with a uniformity in methods of road construction.

Vine A. Simar, civil and mining engineer, Shakopee, Minn. :

Each and every owner of property is directly interested in having the very best roads attainable, not only for the material enhancement of values, but also for the higher and better development of those resources which are of vital importance to our State and country. I heartily indorse any measure promoting that end.

Hon. H. R. Briggs, farmer, member of legislature, Houston, Minn. :

It is my opinion that if the voters are familiar with the provisions of the bill it will become a law. That it will be a departure in the right direction is my candid belief.

Otto Klose, civil engineer, St. James, Minn. :

The proposed amendment is in my opinion an excellent one, and I will do my best to induce voters to indorse it next fall.

Wm. M. Liggett, director of experiment station, St. Anthony Park, Minn. :

The amendment should be adopted as it does not contemplate that the State will build roads, but assist, in a limited way, counties that have enterprise to do it, and help, plan, and instruct those that are interested. My native county in Ohio (Union) has constructed over 700 miles of gravel road free for public travel. Those roads were petitioned for by the land owners along the lines of the road for one mile on either side. I was treasurer four years while these roads were being paid for and never knew taxes more promptly and cheerfully paid. Bad roads no longer impede the travel in any portion of that county. Lands increased in value and many people moved into the county to get the benefit of good roads.

Hon. J. M. Belden, member of legislature, Montrose, Minn. :

I fall heartily in line with the proposition of State aid in constructing and improving public highways and bridges, and believe that I voice the sentiments of a large majority of the people in doing so. It is only a matter of time when every State will have such a law upon its statute books. Let Minnesota be with the foremost.

J. C. Christlieb, civil engineer, Hutchinson, Minn. :

The authorizing of the State to aid in the construction of public highways is surely a step in the right direction and should receive the support of the voters of this State, as better county roads are badly needed.

Hon. J. Q. Cronkhite, farmer, member of legislature, Argyle, Minn. :

I believe that the proposition to improve the highways as embodied in the constitutional amendment proposed in 1897 is the most practical heretofore submitted, and if ratified by the people will prove most satisfactory.

Hon. Joseph C. Wood, member of legislature, Breckenridge, Minn. :

I am in favor of the constitutional amendment referred to for the reasons that (1) it will make possible continuous roads throughout the State, while under the present system they may be good in one township and impassable in another; and (2) under State management the money will be expended more intelligently and the people derive greater benefit at a minimum cost.

Thomas F. McGilroy, civil engineer, Duluth, Minn. :

I am heartily in favor of the proposed amendment and indorse every clause of the amendment.

Jonah Peterman, civil engineer, Granite Falls, Minn. :

The present road system is illustrated by a story: Two Irishmen met a turtle in the road. "Pat," says Mike, "here comes a dead turtle—he has no head." "Bejabers he moves and is not dead," said Pat. They were unable to agree and so left it to a German who came along. The German decided that the turtle's head was off but he did not know it. There is neither head nor tail to our present road system, but the people don't seem to know it. The amendment should be adopted.

Hon. H. R. Wells, president of Minnesota State Good Roads Association :

Good roads are a prime necessity for the moral, social, and national prosperity and advancement of the people. The Federal Government awarded to Minnesota 500,000 acres of land to establish a fund for internal improvements, and it would be criminal to divert that fund to any purpose different from that contemplated in the grant. The Government having been thus liberal to the State, the people of the State can do no less than contribute something from its own resources to supplement the fund. The proposed amendment to be submitted to the electors of the State at the election in 1898 is a worthy means to that end, and should meet the approval of the people at the polls.

Hon. Joseph Underleak, member of legislature, Chatfield, Minn. :

There has been much opposition to creating a State fund for aiding in road building on the theory that favored sections would get the appropriations, leaving other localities "out in the cold." This objection is overcome to some extent by Mr. Douglas's bill, as under it no section can get any great advantage over others. I am in favor of legislation that will give us better roads, thus placing farming communities on a better footing in the ranks of progress and advancement.

Cyrus Northrop, LL. D., president University of Minnesota :

I think that the adoption of the amendment to our State constitution to authorize the State to aid in the construction of country wagon roads would be conducive to the public good.

Charles A. Forbes, secretary Surveyors and Engineers' Society, St. Paul, Minn. :

As an active good-roads worker I shall take the greatest pleasure in helping in any way to get the facts before the voters, so that all may know the nature and value to the State at large of the proposed amendment.

F. Davis, civil engineer, Duluth, Minn. :

I am heartily in favor of State aid in the construction of country roads, as it will enable many counties in the northern part of the State to open up their territory to settlement. I am sure no better inducement can be made to intending settlers than a good road to the nearest town and railroad.

Hon. B. F. Hartshorn, member of legislature, Walker, Minn. :

I favor the principle of State aid to highways and the creation by constitutional amendment and legislative enactment of a fund for that purpose, but do not approve the limitation found in latter part of section 1, nor the provision for a State highway commission.

James J. Hill, president of the Great Northern Railway Co., St. Paul, Minn. :

Good roads are something that we all ought to have. Next to common schools, good roads will benefit the people as much as any other one thing they can have.

Hon. George T. Barr, member of legislature, Mankato, Minn. :

Better roads mean better things for all classes, I believe, and I want them. This proposed amendment may bring them. In the hope that it will I shall support it at the polls as I did in the legislature, and I trust the voters will give it careful consideration and favoring ballots.

James T. Elwell, farmer, secretary Minn. State Good Roads Ass'n, New Brighton, Minn. :

This amendment should pass as it created a small fund to be equitably distributed in all the counties, thereby encouraging the building of good roads throughout the State.

T. A. Hoverstad, Professor of Agriculture, Crookston Agricultural Experiment Station, Crookston, Minn. :

I am heartily in favor of the proposed amendment and hope the same will be carried at next election.

Fred B. Snyder, member of Legislature, Minneapolis, Minn. :

I am a firm believer in good roads. The money spent in their improvement more than comes back to the farmer, and to all who use them, in the saving in wear and tear on vehicles and horse flesh, in the larger load which may be carried, and in the increase of farm values. Besides good roads breed good spirits and lend an air of thrift and prosperity to a community. The State should aid in their construction and maintenance.

United States Department of Agriculture,

OFFICE OF ROAD INQUIRY.

ROAD IMPROVEMENT IN GOVERNORS' MESSAGES.

The governors of a number of States have in the past year called attention to the problem of road improvement. The following extracts from their messages to the several legislatures indicate the present condition of legislation as to roads and give some notion of public sentiment in these communities:

ALABAMA.

Gov. Jos. F. Johnston.

Except education, no more important subject can engage your careful consideration than the improvement of our public roads. The tendency of our people to leave the rural districts and gather in towns and cities is alarming to thoughtful men all over the country. Unless arrested fruitful fields will be abandoned, population congested in the cities and towns, and the very spirit of independence impaired. It is hardly surprising that the citizens who are largely denied church, school, and social privileges by the miserable condition of their roads should seek these elsewhere. Some wise and efficient plan should be adopted permitting counties to levy special taxes or to borrow money, that permanent betterments of our roads may be accomplished in place of the shiftless pretense of work now done. Citizens might be allowed to contribute labor instead of paying money, but the main thing is to have the roads and grades established by competent persons, and the work so done that it will be of lasting value. Several of our counties have special road laws that have been of great advantage, and, wherever good roads have been constructed, the people would rebel against a return to the old system.

CALIFORNIA.

Ex-Gov. Jas. H. Budd.

The legislature of 1895 accepted the road leading from Placerville to Lake Tahoe. The legislature of 1897 made a proper appropriation, and we now have one of the finest public roads in the mountains. I had hoped before this to have seen completed the model road from Sacramento to Folsom, thus leaving a gap of but 30 miles, which the State and counties could have closed during the next two years. In establishing a rock-crusher at Folsom and approving the good roads commission law, I had in view a nucleus for a great system of highways for this State.

Road building has been so crude that the money spent thereon annually (about \$1,700,000) appeared largely lost. To start upon a road system in all directions would be too great an undertaking; but to begin with a well-planned road like the Tahoe one; to establish a rock-crusher that could force down the price of rock values in Sacramento, Stockton, Marysville, and elsewhere; to, later, build a model road to Folsom, join it with the Placerville road; and to add to this, in time, one from Sacramento to Stockton, thence down the valley, then from Sacramento north, would establish the backbone of a road system with great possibilities.

As Sacramento County can not vote bonds for its share of the road to Folsom under a supreme court decision, the State should build the road itself.

CONNECTICUT.

Gov. Geo. E. Lounsbury.

Of the \$100,000 annually appropriated by this State for the improvement of its highways, over \$99,000 were spent last year under the law. Forty-eight miles of road were thus improved. At this rate it will take more than fifty years to build up a general system of good roads throughout the State. Within the last half century enough has been wasted in the unwise building and repair of roads to construct a first-class highway connecting all the hamlets, the villages, and the cities of the State. If you can stop this vast waste, and then, to the money thus saved add appropriations increased by one-third of what you can save by wise retrenchment in other lines of State expense, you can have an unbroken system of excellent roads in less than twenty years. State aid, wisely offered, will incite local interest, and local interest once aroused becomes the strongest factor in solving the problem of good roads. To the road improvement of every town there should be offered a State supervision which gives to each town the benefit of the experience of all the towns, and which enlightens local authority rather than supersedes it.

The poorer towns of the State are already burdened in keeping open and making passable their many miles of highways. For improvement of roads in these towns the State should bear three-fourths of the expense instead of one-half. We can certainly afford to give to our poor towns a proportion of aid, which neighboring States give to rich and poor alike. The money spent on roads in these towns should be used, as far as possible, in giving work to their unemployed laborers. In this way the money goes from the rich State into the poor town, and after it has done its beneficent work, flows back into the State again over the highway which it has built.

There is no real increase in burdens, and the less fortunate share in the general prosperity. The poor hill towns are rich in beautiful sites for summer homes, and good roads are the best ways for opening up these sites to the world.

DELAWARE.

Gov. Ebe W. Tunnell.

This subject has been referred to often by my predecessors in Messages to the General Assembly, and I feel that its importance scarcely needs mention from me. But as our lands are developed and the resources of agriculture become more important we are confronted with the need of better highways as the means of easy and convenient access to markets. Owing to the even surface of our land it should not be difficult or expensive to make and maintain good roads. In an agricultural community nothing adds more to the comfort and convenience than well kept roads, and few things add more to the attractiveness and beauty. Liberal appropriations are annually made for this purpose, and with careful management our roads should be kept in good condition. But, either through ignorance of the proper methods of building and improving them, or a settled custom of inadequate patching and mending, they are far from what the expenditures would justify. Much of the money is spent on unnecessary roads, laid out for the convenience of individuals and of doubtful public benefit. In many places they parallel each other in close proximity, while other sections are deprived of the needed conveniences. Then, too, much of the money spent finds its way into the pockets of overseers in payment of the per diem in overseeing two or three men. I do not mean to reflect on the honesty of overseers, but to condemn the system under which they act.

INDIANA.

Gov. Jas. A. Mount.

Good roads are indispensable to progress and development. The highest attainments in rural life, socially, mentally or financially, can not be attained when bad roads abound. Discontent with country life is the fruitage of the thralldom of mud roads. Two years ago I said to the General Assembly that, "while the road laws needed improving, their execution needed revolution." The same need exists to-day in an aggravated form. The law requiring the road supervisor to work all able-bodied men on the highways during the months of April, May, and June, in many instances, is not faithfully enforced, and in some cases it is absolutely ignored.

The average road levy by the township trustee is about twenty cents on the one hundred dollars. This raises a vast revenue, which is not expended with judgment and fidelity. The railroads of the

State are assessed, in round numbers, at \$154,000,000. This would create a revenue of nearly \$300,000. This is "farmed out" between the railroads and the supervisor. A discount is made to the railroad, the "go-between" makes his thousands, some of the Supervisors profit by the method, and the cause of good roads suffers. The farmer is allowed to work out his road tax often by a slipshod method, which, if pursued by a road contractor, would end in bankruptcy. The supervisor should be held under bond to faithfully execute the duties of his office. He should be given power to compel every man owing service to the highways under the law to perform the same. All road tax should be paid in cash, reserving to the payer the right to work out the same, for which he should be paid in cash, provided he responds to the call of the supervisor when given the opportunity to perform such work, and accepting the lawful price for such services.

KANSAS.

Gov. W. E. Stanley.

Our natural roads are good, and yet very much could be done to improve them. Better roads would be of great advantage to the farmers, by bringing them in effect much nearer to their respective markets. We have done very little toward improving our highways, and as a result much time is lost in going to and returning from home markets. We have large quantities of stone suitable for improving our roads, and, unless our convict labor is employed in the work of supplying our public institutions, it might be utilized to good advantage in the work of building good thoroughfares. Some means should be provided for carrying on the work of this much neglected improvement.

MARYLAND.

Gov. Lloyd Lowndes.

The two elements, aside from climate, location and other natural advantages, which are most attractive to settlers, are low taxes and good roads.

There is an increasing demand in all the States for a better road system, and if we would not be behind in the line of progress in this direction, it is important that we should aim toward a general improvement in our system of roads.

This subject has received the serious consideration of the various organizations more immediately interested in the development of our public highways, and there will be presented for your consideration the results obtained by practical experience and comparison of the most approved methods.

I sincerely trust that some comprehensive and satisfactory solution of the question may be reached, which, while not being a burden

upon the taxpapers, may lay the foundations of a system which will eventually meet the necessities of the different localities of our State.

MISSOURI.

Gov. Lon V. Stephens.

The question of road improvement should, and will, I am sure, engage your earnest consideration. Neglect of our public highways in the past has occasioned untold inconvenience, retarded development in the State, and proved costly. A great diversity of opinion as to necessary action has heretofore prevented the legislature from reaching a satisfactory conclusion, but the importance of improved public highways to a full development of the State's agricultural and industrial pursuits suggests that prompt and efficient action should not be further delayed.

The present law has not given satisfaction. Its multiplicity of provisions is not understood; many are inoperative and some are colossal failures. Road improvement has not been commensurate even with the revenues expended. Poll tax paid in labor, as under the present law, yields but slight returns and can not be depended upon for highway improvement. The injudicious expenditure of road funds is the rule rather than the exception. In only a few instances has any system been adopted looking to permanent improvement. Generally speaking, the roads are badly located, no grades have been established, no underdrainage of the roadbed has been provided for, and the surface drainage, if any, has been crudely and imperfectly done. Culverts are temporary make-shifts, bridges are cheap and dangerous structures, all indicating that the advice of a competent engineer is a necessity in economical and successful road construction, and that the work should be directed by a skilled road builder. The road laws should be revised and simplified. All revenues for road purposes, both poll and property tax, should be paid in cash.

When a system is perfected for the economical and judicious expenditure of the present available revenues, the people will promptly respond to any reasonable demand for increased road taxes necessary to material and permanent improvement.

NEW HAMPSHIRE.

Gov. Frank W. Rollins.

The subject of good roads was deemed of sufficient importance by the dominant party in this State to incorporate in its platform a separate plank on this point which reads as follows :

We favor a conservative movement for the permanent improvement of the public roads of the State. Good roads enhance the value of property, especially in the farming districts; attract thousands of visitors who come to enjoy the grand scenery and healthful influences of the State; shorten the distance to

market; and are potent factors in the development of every community. We favor such action by the State as will bring to the knowledge of local officials the most successful methods of maintaining the roads committed to their care.

It is fair to assume that no party is opposed to the spirit of this resolution, and that it meets with the approval of the people of the State. The subject was discussed by the master of the State Grange in his recent address to that body, in which he recommended the appointment of a State engineer in the interest of good roads, which suggestion was indorsed by the Grange. The resolution adopted by the Republican State convention approves of a conservative movement for the improvement of the highways of the State. It is a beginning which is now asked that shall be developed and extended when the State is in a better situation to lend material aid to such improvements. The details of any comprehensive plan for the permanent improvement of our highways must necessarily be worked out with care, and such general plan must be in part the result of experience. Yet the direct and indirect benefits to the State from such improvements are such as to enlist at this time your most earnest efforts that some beginning be made. I suggest that a small sum be appropriated for the construction of a model section of highway in some town or towns, which will appropriate at least an equal sum, the entire expenditure to be made under the direction of a temporary commission, to be appointed by the governor and council, and to serve without compensation, the commission to have authority to employ a competent engineer.

NEW YORK.

Gov. Theodore Roosevelt.

The Legislature should see that the excellent movement to better our roads is continued, and that it is conducted primarily in the interests of the farmers and market gardeners.

NORTH CAROLINA.

Gov. Daniel L. Russell.

A more widespread and intelligent interest in the betterment of the public roads of the State is everywhere apparent. This interest has been steadily growing during the last decade, and it is evidently one of the most vital economic problems before the people. There is need of better and more uniform legislation in the interest of this movement, and at an early day a report will be presented to you embodying an abstract of the different county and State road laws now in operation, and also much information concerning methods of road building. There is also great need in this State of more intelligent and experienced road engineers and supervisors, so as to avoid a wasting of money and labor in carrying out worthless plans for work. Our people should realize that the building of good public

roads requires as much training and experience as does the building of railroads. The system of compulsory labor on public roads has been abandoned in most enlightened countries. In our State it is questionable whether we are in a position to adopt any uniform system upon this subject because of the wide variance of the conditions existing in the different localities. In some places the property holders are able to bear the road tax, and the circumstances surrounding them are such as to make it to their interest to do away with the compulsory system. In other localities, perhaps, the road tax would amount to such a hardship as to make it impracticable. The plan of employing short-term convicts on the roads has proved economical and satisfactory in a number of counties in this and other States, and the system could be well extended. In several States even the long-term convicts have, with satisfactory results, been employed in quarrying and crushing stone for Macadamizing public roads, and the material thus prepared has been sold to the various counties and municipalities at the actual cost of preparing it, thus reducing its cost one-half or two-thirds. Of course, no amount of legislation will of itself radically change the existing conditions, but perhaps laws providing for the working of the public roads may be enacted so as to stimulate and direct better work in this direction.

It is coming to be generally recognized that the use of wide tires on all wagons and other draft vehicles will greatly aid the keeping of public roads in better condition. In a number of States laws have been enacted encouraging the introduction and use of these wide tires, and the results there are said to be highly satisfactory. It is desirable that legislation looking in this direction should be enacted in North Carolina.

OHIO.

Gov. Asa S. Bushnell.

Legislation which will make the burden of taxation as light as possible, which will conserve general good causes, which will cheapen and facilitate the cost of transportation in agricultural districts through the institution of a good roads system, and which will unite more closely the city and the country population by rapid transit will do much to benefit all, and none more so than those who till the soil. For the claims and interests of the agriculturists I bespeak the most patriotic consideration.

OREGON.

Ex-Gov. Wm. P. Lord.

There is at this time an active interest being taken in the subject of good roads. The movement should be encouraged. Good roads are of such public utility and importance and are of such general

interest that measures designed to secure them will be submitted for your consideration and action. Our present law is lamentably behind the age in the matter of road improvements; it ought to be gotten rid of and some other adopted looking to a systematic effort to improve our public highways. A new system should be provided. All road taxes should be paid in money, and the present system of working out road taxes at extravagant wages under supervisors, often selected without reference to their qualifications, should cease. I earnestly beg your attention to this subject, in the hope that you will bring about some legislation that will result in securing the improvement of our roads.

Gov. T. T. Geer, in Inaugural Address.

Few questions demand more serious consideration at your hands than the enactment of some system that will give our people better roads. Good roads are not only the arteries of commerce, but they affect the very vitality of the business interests of the entire State, and especially of the country districts. That they are profitable, pleasant, and necessary is not questioned by anybody. No one feature of any country gives it a more creditable reputation than a system of good roads, and perhaps no country needs it more than Oregon. The fact that we are blessed with a climate that is a perpetual guarantee against drouth makes it certain that we will always have bad roads until we overcome them by systematic legislation. This we have never had, nor has any serious attempt ever been made in that direction. Surely there is no reason why this matter should be further postponed.

Our present road laws, taken as a whole, amount to a mere travesty on the object for which they were intended: They are the result of haphazard, patchwork legislation from session to session, usually amendatory of previous acts that were themselves mere apologies for existing conditions. There is ample justification for the statement that, with exceptions so few as to be unworthy of mention, the average country roads in our State are in no better condition than they were thirty years ago. There are many roads in Oregon that have been traveled regularly for more than thirty years through thickly settled communities and that have never been so nearly impassable as during the last year. This discouraging condition is wholly attributable to the absence of an intelligent application of the efforts put forth for their improvement. If all the road work in Oregon during this period had been applied to their systematic draining, grading, and top dressing with gravel or crushed rock, we would to-day have as good a system of roads as any State in the Union. The amount of human energy absolutely thrown away is prodigious, but in no instance, perhaps, more inexcusably so than in the matter of alleged work on our roads.

While our people are a unit as to the necessity and desirability of better roads, it is not possible to bring about that condition until our present system is wholly revolutionized and our road taxes are collected the same as other taxes, to be disbursed under the intelligent supervision of some competent person authorized by each county to look after the roads of that county. The experience of a generation should be sufficient to convince the most hopeful that even another generation of our present haphazard method would give us no improvement whatever. After all these years we should be satisfied that the system of "working" roads is a dismal failure and adopt a system that contemplates the building of roads. I believe our people are public spirited enough to welcome a law imposing a moderate levy for road taxes if attended by an ironclad provision that would secure its economical and effective application to our roads. This should be attended by a provision encouraging the use of broad-tired wagons and discouraging the use of narrow tires after a specified time in the future. In France, as well as in some other countries, many wagons now used have tires 5 inches wide; and, with the hind axle some wider than the front one, a heavily-loaded wagon traveling the road is a positive benefit to it. We will never emerge from our present condition of deplorably bad roads until some legislature goes far enough at one stride to leave permanently in the rear the mockery that binds us now.

RHODE ISLAND.

Gov. Elisha Dyer.

There is an ever-increasing necessity for good roads, every interest in the State calling for them. This matter has passed the experimental stage, and the sample half mile has not been a success. The question is now a practical one how the several towns, out of the appropriations and material available, can construct and maintain good roads. A year ago the greatest interest in this subject was manifested all over the State. An act, carefully drawn and modeled after the Massachusetts law, was presented to the legislature, and hearings upon it held. Expert road engineers came from outside the State to assist the friends of the measure in carrying it through, but it failed to become a law.

Through the courtesy of the chairman of the highway improvement committee, L. A. W., inquiries were made in relation to the amounts appropriated by the cities and towns for ordinary and regular repairs upon roads, and also for extraordinary repairs, such as rebuilding and Macadamizing existing roads; and what amount, if any, had been appropriated for new roads during the year 1898. This information, in a tabulated form, will be found among the appendices of the message. So much has been done by the cities

and towns themselves that it seems to me it is unnecessary to continue in operation Chapter 73 of the General Laws; and if we are to have a highway commission, and one which will, in my opinion, accomplish what is desired of it, I respectfully suggest that this chapter be repealed, and that we start again, untrammelled, from the beginning.

VERMONT.

Gov. Edw. C. Smith.

The second thought I desire to urge is the necessity at this session of positive, radical, vigorous action in respect to good roads.

The present relation of the State to the highways, with all due respect to the framers of the law, is entirely wrong. Under the present law, over \$86,000 a year, 5 per cent of the grand list of the State, is collected, and the same amount redistributed to the various towns, and 246 highway commissioners spend each town's proportion of this \$86,000 in keeping in repair the highways of each particular town—or are supposed to do so. The State has no voice or direction as to how or when this large sum of money shall be spent, and no control or jurisdiction over it whatever. As a matter of fact, if I may rely upon the best information I have at hand, there is not one dollar of this money that goes into permanent work, or that furnishes lasting benefit to the State. There is no report made thereof to the State whatever. No man in this Assembly would apply the principle that controls the distribution of this 5 per cent State tax for highways to his own business. No man with an income of \$86,000, or less or more, would allow 246 or any number of his servants—however good—to spend it without any voice or control or exercise of any accountability respecting it whatever. How, therefore, can you do your duty as legislators and allow this condition as to \$86,000 of the State's income to remain as it is?

This state of affairs is no fault of the highway commissioners of the several towns, and no criticism whatever on them. It is incident to the law itself which dissipates the benefits that would accrue to the State if this \$86,000 was directed from one standpoint, or by the State. The idea that underlies this law relating to the redistribution of the 5 per cent tax is that it aids the poorer and smaller towns; but this is not true in my judgment. The idea is, for instance, that the town of Hancock, which on its grand list is assessed \$58.19, receives in the redistribution on its mileage \$130.48. But of this \$130.48 the town pays out of its own pocket \$58.19, so that in reality its gain on redistribution is but \$72.29. This is less than \$3.30 per mile on its 22 miles of road. Practically it is no help at all towards rebuilding and maintaining the roads of Hancock. This is but a fair statement of what each of the smaller towns of the State receives in the way of lasting substantial benefit. In reality it is of

no permanent benefit whatever and amounts to nothing. The \$86,000 spent in this way each year is spread out so thin that the money is practically thrown away and is wasted.

The amount received by each town in excess of the 5 per cent is far below the loss that inures to every inhabitant of each of these towns who owns a horse or drives a team over its poor roads. I have taken pains to have statistics prepared to show the cost of transportation of the products of Vermont from various towns which lie away from the line of the railroads to the railroads, as compared with the cost of transporting the same articles from the railroad to market. From these statistics it appears that on butter, lumber, granite, lime, brick, and hay the rate is \$2.50 to \$4.00 per ton to team from the point of production to the railroad, while the rate to haul the same articles from the railroad station to the point of consumption is from \$3.40 per ton down to \$1.66 per ton. In none of the instances does the haul by team exceed 12 miles; in none of the instances is the haul by rail less than 140 miles. The rates by railroad will never, in my judgment, be higher, so that whatever can be saved by improved roads out of the cost of teaming these products ought to go into the pocket of the producer of the hay or butter, or the lumber or granite, or whatever is teamed. The standard authorities give the saving in cost of teaming over *good* roads as compared to ordinary dirt roads, to be from 50 to 75 per cent; so that there is from \$1.25 to \$3.00 for every ton of freight teamed, to go into the pocket of the producer in Vermont, if only good roads are made where bad ones now exist. Looking at it, therefore, from the standpoint of the smaller towns away from the railroads, the benefit that would result to the inhabitants thereof by the expenditure of this money in making the roads good would infinitely exceed the amount received each year in the redistribution of this 5 per cent from the State highway tax. So far as the larger towns are concerned it is obviously for their advantage to change this highway law and to have better roads. It seems to me these are strong reasons for changing the law and securing better roads and the solution is clear and easy. If this Legislature will direct that the expenditure of the \$86,000 collected each year from the State highway tax be devoted under proper restrictions to building highways from these smaller towns to junctions with the railroads, or into the larger towns, it will be but a few years before these smaller towns reap a benefit a hundred-fold over the present arrangement. You can not reap any benefit in this direction by having 246 heads control the distribution of the \$86,000, as under the present law. You must put it in the hands of a few, who must be experienced in the business and responsible to and controlled by the State. The State of Massachusetts, and many of our sister States, have already seen and proved the wisdom of State

care of highways; it is no experiment. I earnestly ask that the highway law of Massachusetts, modified to suit the exigencies of our State, be adopted here. I recommend the appointment of highway commissioners to whom shall be turned over the 5 per cent highway tax, who shall control the expenditure thereof under the provisions hereinafter named, and who shall have charge of what shall be called State Roads. The expenditure, for the present at least, in a general way ought to be for improving and making permanent the roads from the smaller towns to the lines of the railroad, and the work should be distributed fairly among the different counties of the State, so that no one shall be favored over another. Where permanent work is decided to be done in any of the particular towns, the selectmen of such town should be first offered the contract, so that the money for such work shall be spent in such town; in the event the selectmen decline, the contract to be afterwards let by publication, the bids of Vermonters in all cases to be given the preference. Provision should be made that no road can become a State road except through the request of the mayor and aldermen of the city, or the selectmen of the town where the road is located, so that where any town or city desires to have the State assume any particular highway, it must be by petition to the highway commissioners and in this way the cities and towns will keep control of the matter entirely. When, however, such a petition is made to the highway commissioners, and is granted, the road described should thereafter become the property of the State, and be subject to the jurisdiction of, and repair by, the State. This is in substance the present law of Massachusetts, and you will make no mistake in following it.

In making the proposal for a State road commission, and for the expenditure of this money in making good roads, I do not wish to be understood as meaning to propose to make city roads out of country roads, but simply to insure permanent work on the traveled path only. The traffic in this State is not so heavy as to require roads of over ten feet in width, in my judgment, and by confining the commissioners to this width and to proper construction the money will go much further, and avoid that extravagance which is the most serious menace to the success of good roads.

It is a curious fact that civilization and good roads go hand in hand; the higher the civilization, the better the roads. This is true the world over.

The United States has made enormous strides in other methods of transportation, but until recently has been singularly remiss in the matter of good highways. Our sister States are now fast realizing the incalculable benefits of them not only as profitable highways for traffic, but as civilizers and advertisements to secure the patronage of summer tourists and vacation residents. They are spending mil-

lions of dollars in improving their highways, they are reaping the benefits in increase of summer population and of wealth. Vermont, with natural attractions rivaling any of our neighbors, cannot afford to delay vigorous progress in the one direction that will produce the greatest immediate and lasting benefit to us all.

I earnestly hope you will adopt the principle in the above method of dealing with this subject, and then pass as large an appropriation in addition to the 5 per cent highway tax to carry out the law as your consciences and sound judgment will permit.

Ex-Gov. Josiah Grout.

Better roads are so undeniably desirable that all sections of the country have become interested in securing them. Some of the States have provided means and adopted practical ways for permanent road work, some are still discussing the subject, while this State distributes among the towns \$87,000 of State money annually, raised for permanent road work, which is too frequently used to patch roads, and in some instances for ordinary town purposes.

For generations in this State we put toward a half million each year on roads—not only into them, but upon them—and the roads were from year to year the same poor ways, over which a patient public jounced and stumbled. A few years since only our eyes opened and the need of better roads gradually became a conviction which six years ago ripened into a five per cent State tax, authorized to carry on permanent work. A State commission with authority to suggest as to the character of this work and application of this tax was created, and, though it had rendered a valuable service, and it is believed accomplished much good, it was dropped two years ago, leaving the fund thus dedicated to permanent road work entirely to the town road commissioners. There should be a State supervision of its expenditure, or the fund, which is in the nature of a trust created for a given purpose, should cease.

Permanent road building is not accomplished by ordinary highway work, but by constructing roads that will take care of themselves for a reasonable time. Permanency should be considered with reference to locality, travel, and other kindred conditions, and should not be made too expensive. Extravagance is a danger to be avoided as one that will imperil the whole enterprise. We should regulate our progress in this respect by practical economy.

The roads of the State have been noticeably improved within the last decade, and if we wisely push forward the work so well begun, a greater improvement will follow in years to come. Massachusetts has probably made greater progress in permanent construction than any other State, and expends toward a million of dollars annually in aid of this work on a plan it might be well for you to consider.

The better you make the roads, the more your farms will be worth, and all the more will summer tourists come within our borders.

If you should raise the State tax to 12 per cent and expend every dollar of the probable \$200,000 such a tax would annually command under competent State supervision, the State would enter upon an era of prosperity that can be afforded and would be enjoyed. Remember it requires money to make roads. Do not bond, pay as you go, but get permanent roads as rapidly as can be considered consistent with our financial ability.

WEST VIRGINIA.

Gov. Geo. W. Atkinson.

Nearly \$700,000 is being practically wasted upon our public highways every year, as little or no permanent improvements are being made. The cry from every section is for some system of permanent road building. The State will never reach its highest development until this problem is solved and good roads checker our State in every direction. Our roads are arteries of commerce, and no pains or expense should be spared to secure the greatest possible improvement along these lines.

I refer with gratitude and pleasure to the ten supplemental reports to be found in the report of the board of agriculture. The bringing together of all the agencies which are at work in the State for the development of agriculture will prove a convenience which will be appreciated by all who are interested in it. All of these associations and societies, I am informed, are working in harmony with the board of agriculture, and are assisting greatly in the consummation of its plans.

Before leaving this subject, I desire to indorse most heartily the efficient and helpful work of this board in my efforts to develop the the great natural resources of our State, and I express the hope that everything which this board has asked in the way of appropriations may be cheerfully granted. I believe the recommendation is reasonable and right, and I am confident it will be heartily approved by the great army of agricultural taxpayers throughout the State, and carefully, economically, and judiciously expended in the interest of agriculture, and to the advantage and betterment of the whole people of the State.

ROY STONE,
Director.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., May 1, 1899.

United States Department of Agriculture,

OFFICE OF PUBLIC ROAD INQUIRIES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROAD INQUIRIES,

March 29, 1900.

SIR: I have the honor to transmit herewith, and to recommend for publication as a circular of this office, the accompanying article by Mr. W. H. Moore, St. Louis, Mo., on "The Social, Commercial, and Economic Phases of the Road Subject." Mr. Moore is president of the State and Interstate Good Roads and Public Improvement Association, and has had much experience in agitating, organizing, and educating people upon the subject of good roads. What he has to say in the accompanying article seems to me to be of sufficient importance to justify its publication and distribution.

Very respectfully,

M. O. ELDRIDGE,
Acting Director.

Hon. JAMES WILSON,
Secretary.

THE SOCIAL, COMMERCIAL, AND ECONOMIC PHASES OF THE ROAD SUBJECT.

THE PRESIDENT'S ROAD MESSAGE.

The President in his last message to Congress directs attention to the road subject as follows: "There is a widespread interest in the improvement of our public highways at the present time, and the Department of Agriculture is cooperating with the people in each locality in making the best possible roads from local material and in experimenting with steel tracks."

These are the first words in recent years contained in a Presidential message upon one of the most important of all public questions. They should stimulate Congress to appropriate necessary funds for the Office of Public Road Inquiries, or the establishment of a national highway bureau that may widely circulate literature, send experts into all States and Territories to instruct students in the agricultural colleges, build sample roads as object lessons, and make possible a uniform system of road laws. We find that thirty-one States have created labor bureaus or bureaus of industrial statistics, agricultural and kindred departments, but not more than half a dozen States have highway commissions which have competent jurisdiction over road affairs. Those States, viz, New Jersey, Massachusetts, California, Connecticut, Rhode Island, and New York, have made greatest progress in road improvement.

NECESSITY OF HIGHWAY COMMISSIONS.

It would seem from such examples that one of the first and most necessary steps in each State should be to legalize a bureau of highways, or the appointment of a nonpartisan highway commission, whose chief duties should be—

- (1) To establish a capable engineer or surveyor in each county.
- (2) To locate all roads which are to be built on public domain.
- (3) To systematize local laws.
- (4) To locate the most suitable material for road purposes.
- (5) To collect all poll taxes in cash instead of continuing the unsatisfactory work-out-road-tax system now prevalent in most States.
- (6) To furnish specifications and to encourage road building by contract, giving farmers most directly interested the right to bid.
- (7) To keep the road question free and independent of partisan politics. To remove the four thousand or five thousand supervisors or road overseers now appointed in each of many States and substitute three commissioners in each county.

It would also be the duty of highway commissions to equalize road taxation so far as possible. In many States the farmers own less than a fifth of the total taxable wealth, yet they are constructing and repairing all the roads of the commonwealth. This is surely an unjust and unwarranted burden upon the suburban classes.

DEFINITION OF A ROAD.

“A road is defined as a public thoroughfare, or that on which one rides or travels; a road or avenue cut in a wood or through grounds to be used as a place of travel. The word is generally applied to highways, and as a generic term it includes highway, street, and lane.” It has been carefully estimated that 99 per cent of every load hauled by railroad, steamboat, or express must be carried in a wagon or truck over a highway. We need no more convincing proof than this to indicate that all cities, manufacturers, corporations, and laborers are interested with the farmer in the great problem of rapid and economical road improvement.

ADVANTAGES OF ELECTRIC CARS TO LABORERS.

The advent of horseless carriages and other electrical improvements will have a tendency to change the modes of farm life as greatly as electric street cars have changed the conditions of modern city life. Laboring classes are no longer compelled to live in the smoky, congested districts of cities, but can go 20 miles into the country for a nickel, buy a comfortable home from the savings that formerly went for excessive rents, enjoy pure air, and cultivate the growth of vegetables, fruits, and flowers.

In future thousands of farmers will live in the suburbs of cities, enjoy educational advantages, breakfast at home, do a day's work on the farm 40 miles away and return at night to enjoy supper with the contented family.

THE SOCIAL SIDE.

The common roads of a country are not only necessary to its development, but their condition is a measure of its civilization. The highest type of mental and moral culture and development can not be attained without the means of easy and rapid communication between all parts and sections of the country. The railway and telegraph lines are the great modern civilizers of the world; but they are limited in their spheres of usefulness, because they do not reach the farm, the home, the country schoolhouse and church. The common road is the connecting link between these, and without it the progress of a widespread civilization must of necessity be greatly retarded. They are the foundation stones upon which the superstructure of society is erected and upon which its symmetry, beauty and stability must rest.

It has been stated by eminent writers that railway and telegraph lines with the wonderful commercial enterprises they make possible are in the end detrimental to a country that has no proportionately adequate system of common highways, because of their tendency to congest the population by drawing the intelligent and ambitious portion of the country youths to the cities and centers of commercial enterprise, until the avenues of that class of labor are overcrowded, the wages of labor decreased by undue and unnatural competition, and the surplus set adrift without the means of a livelihood, to become beggars or criminals, instead of delving in the soil from which the primary wealth of the world is secured, and in which avocation there has never yet been a surplus of labor.

Then, too, it is the youthful, intelligent, rugged, and ambitious who are thus being coaxed from the farm, whose society is needed to stimulate the sluggish, who are always content to see the world's great cavalcade go by while they remain in slothful isolation. If these conditions continue there is danger of a barrier being built up between the different classes of our people that will destroy that sympathy, intelligence, and cooperation that is so necessary in our mutually dependent condition.

Neighborhoods, counties, and States, separated from each other by the barriers of practically impassable roads, in their loneliness degenerate into a condition of moral stagnation from which it is difficult to arouse them to a common and mutual interest and understanding.

Professor Shaler, of Harvard, says: "It is doubtful, indeed, whether a sound democracy, depending as it does on close and constant interaction of the local life, can well be maintained in a country

where the roadways put a heavy tax on human intercourse." These words are prophetic and worthy the universal consideration of a people whose unparalleled progress of a century and a quarter seems to have rivaled and outclassed all other nations that have ever been born. We must not stifle our civilization through commercial blindness and neglect.

In view of all these facts, and in the light of the benefits that have accrued and are accruing to the civilized countries of the old world from their splendid systems of common highways, and with all of our progress along every other line of public development, it seems strange beyond comprehension that we should have in the United States the poorest system of common roads to be found in any country possessing a stable government, and that our Federal and State governments, our law makers and statesmen, should be giving the problem so little of thought and attention. Indeed, it seems a fact that the same importance is not now attached to this question that was accorded it by the founders of the republic. It even seems clear that the framers of the Constitution contemplated the maintenance of a system of national roads by the General Government as a necessity for national defense and the distribution of mails. And after its adoption Alexander Hamilton evolved a plan for a system of intercolonial highways. The question was not overlooked by Washington, who, during the Revolution, when confronted with the necessity for roads over which to move his armies, and looking to the future needs and possibilities of the country, wrote to Patrick Henry (then governor of Virginia) and urged that the power to open, build, and repair highways be taken away from the county courts and vested in the State. John Gilmer Speed, in a very able article on the question of "The Common Road as a Social Factor," says:

If the common roads had been properly laid out, constructed, and attended to, and their development had kept pace with the development of other highways, I suspect that we would now have other problems to solve than those that confront us. * * * We should not have a dissatisfied agricultural population, worried by debt and harassed by care, so that any demagogue with a promising nostrum is listened to with enthusiasm and respect; we should not have the countryside suffer because of a lack of labor, and the poor in the crowded cities suffer from a lack of work.

GOOD ROADS AND RURAL FREE DELIVERY.

There is a phase of the question of improving our common roads that has not yet been given much public agitation, and which from a moral and social standpoint affects our rural population as much as any other phase of this important problem. It affects them in scarcely a less degree from a financial standpoint. This is the necessity of better highways in the country districts as a means of securing rural free delivery of mails.

Our postal system in the United States has been developed into a remarkable state of perfection in recent years, and, with the aid of the electric telegraph, the steam railway, and the modern newspaper, has practically annihilated distance and brought the whole world in touch.

Every event and transaction of importance throughout the world is given publication in all our large cities within a few hours after its occurrence, and the iron horse stands panting and ready to carry these papers to all the inland towns, so that papers published at 2 and 3 o'clock in the morning are read at breakfast tables more than a hundred miles distant at the same moment that they are read at breakfast tables within a few blocks of the office of publication. Before the day is over the people of all the inland towns have read the news of the globe.

Who is it that fails to get this news the same day and to keep in touch with the world's happenings? Only the farmers who reside away from the towns and the centers of mail distribution.

It is the policy of the Government to give equal service to every section of the country in the distribution of mails, and whatever favoritism to class or section has been charged to any political administration, this branch of the service has been always above suspicion.

Then it may be asked: Why it is that the farmer pays the same rate of postage on his mail that is paid by the resident of the city, and yet has to ride miles to a post-office to get his mail, while the latter has his delivered at his door at least once daily, and in many instances oftener? The answer is plain and easy. The Government gives the best service that the condition of those served will permit. Its constant aim is to increase and better the service given. In doing this it must look to the cost and keep within the appropriations for and earnings of this Department of the Government. It is always easier to serve a large number when they are congregated in a small space, and for this reason it is not only easier to serve the people in the matter of mails in the centers of population and of converging lines of transportation, but this service can be rendered at a minimum of cost to the Government, and it is practicable to deliver their mails at their homes and places of business.

Recent experiments have also demonstrated that this service can be extended in many localities to the rural population by saving the expenses of star routes and the cost of local post-offices. There is one obstacle, however, that has confronted most of the efforts to extend this system, and this obstacle is most prevalent in the Middle, Southern, and Western States, and that is the absence of roads over which carriers can cover sufficient territory in a given time and with regularity at all seasons of the year. The experiment has been carried to a sufficient extent to demonstrate that it would be entirely practicable if the country roads were macadamized or otherwise made passable at all seasons, so that a carrier could regularly cover a route of fifteen to twenty miles daily.

What greater benefit could accrue to a farmer living a number of miles from a town or post-office than to have his mail delivered daily at his door? How much of the monotony of his isolation would be

removed if he could receive his daily paper, read the news of the outside world, watch the markets for his products and be able to take advantage of prices that are often lost to him, and see his children happy and content, instead of restless and dissatisfied, or else growing up in the stolid indifference that is the outgrowth of mental lethargy and ignorance.

It is difficult to determine the financial benefits the farmer would receive from the establishment of the system of rural free delivery throughout the country, but First Assistant Postmaster-General Perry Heath, who has made it a study and is probably its foremost champion, treating of the question in his last annual report, sums up the benefits to farmers in this terse and forceful way:

Enhancement of the value of the farm lands reached by rural free delivery. This increase of the value has been estimated as high as \$5 per acre in some States. A moderate estimate is from \$2 to \$3 per acre. A general improvement of the condition of the roads traversed by the rural carrier. In the Western States especially the construction of good roads has been a prerequisite of the establishment of rural free delivery service. In one county in Indiana a special agent reports that the farmers incurred an expense of over \$2,600 to grade and gravel a road in order to obtain rural free delivery. Better prices obtained for farm products, the producers being brought into daily touch with the state of the markets and thus being enabled to take advantage of information heretofore unattainable.

And then he very forcefully adds:

To these material advantages may be added the educational advantages conferred by relieving the monotony of farm life through ready access to wholesome literature and the keeping of all rural residents, the young people as well as their elders, fully informed as to the stirring events of the day. The moral value of these civilizing influences can not be too highly rated.

But let the rural population not fail to observe that the statement is made that "the construction of good roads has been a prerequisite of the establishment of rural free delivery service," and it will be continued a prerequisite in the future. It is an old adage that "The Lord helps those who help themselves," and the Government seems to think it a rule worthy of emulation. This great boon of rural free mail delivery with all of its conveniences and educational and moral influences will be denied those communities that lack the energy and spirit of progress to pave the way for it by paving the ways over which the mail must be carried to their homes.

A PARTIAL SOLUTION OF THE LABOR PROBLEM.

In addition to the moral, social, and financial advantages to the agricultural and commercial interests of the country to be derived from a better system of common roads, the labor their construction would furnish to the army of idle men throughout the country is a question well worthy of the thoughtful consideration of every intelligent citizen. It may at least assist in a partial and temporary solution of the labor problem.

The halt, the blind, and the decrepit must ever be the wards of the State or the beneficiaries of private contributions to charity, to be housed and fed free of charge and without regard to any personal effort upon their part. This is incumbent upon every civilized government and Christianized people; but this should be the limit of gratuitous charity. To go beyond this point is to encourage idleness and put a premium upon vagrancy and crime. Every able-

bodied man should be compelled to "earn his bread in the sweat of his brow" unless government itself renders it impossible for him to comply with this Divine command.

A broad system of public highways would put to honest labor many men now idle, would stop the gratuitous distributions of funds by individuals to tramps and beggars, would greatly decrease the amount of crime and the cost of prosecuting criminals and maintaining prisons, and would mark an era of national progress in the United States that would have no precedent. It would add millions to the national wealth while relieving the want and destitution of many people.

A QUESTION OF PUBLIC POLICY.

The subject of building and maintaining better highways in all the States of the American Union is a question of public policy, and as such should be forced into public notice and discussion equally with all the other great economic questions that are discussed by the people and decided at the ballot box. While it has a moral side, it is not a moral question that can be left for its solution to each individual. It must be treated as a policy affecting the whole people, the material welfare of the Nation, and one upon which the future advancement and welfare of the Republic depends; and as such it becomes an issue of as great importance as the tariff, the money, or the expansion questions, to be eventually settled at the ballot box, where the sovereign citizen settles all questions that affect his interest and require taxation to consummate.

True, it may be said that each State adopts its own road laws, and the question is settled by the voters now; but it is not made an issue in any State. It has practically been treated as a settled question. It is agitated in no campaign and made a plank in no platform. No legislative candidate of the people—county, State, or National—is required, as a condition precedent to his election, to declare his policy on the question of the betterment of the public highways. It is true each State provides for a tax levy for road work, and for the election of supervisors to control such work. Beyond this State laws are sometimes a jumble of crude and impracticable ideas. The laws enacted are without meaning; those elected to enforce them are chosen without enthusiasm and often without reference to their qualifications; the men who do the work under their direction, in most of the States, are discharging a poll tax with the least possible amount of labor, and are working largely without plans, specifications, or directions, and the result—the only one that could be expected—is a road without grades or drainage, that is dust in summer, mud in fall, spring, and winter, and the dread of every traveler who must pass over it.

As a means of interstate communication it should become in some way a question of Federal importance, and be forced beyond the point of discussion in occasional public improvement conventions, newspaper, and magazine articles, and carried before the people in such a manner that all classes may be aroused to its importance as an economic problem that is burdening them now with taxation that is fruitless of results and that is greatly retarding the progress of their country.

Every State of the Union should have a settled policy on the kind of roads it shall construct, and every county should see to it that no

citizen be allowed to represent it in the legislative halls of the State without a pledge to work faithfully for the enforcement of such policy. Then, and not until then, will the condition of our public roads cease to remain discreditable to our country and a menace to our further development and civilization.

INTERSTATE CAMPAIGN.

Early in 1899 the Interstate Good Roads and Public Improvement Association inaugurated an interstate campaign never before equaled in this country, unless by the agitation of The National League for Good Roads and the League of American Wheelmen. The officers of this association visited the leading cities of the States of Minnesota, Wisconsin, Iowa, Illinois, Missouri, Tennessee, Arkansas, and Texas, and organized thirty-eight district and State conventions, constructed thirty-four sample roads of macadam, gravel, and sand, as object lessons, under the direction of Mr. E. G. Harrison, expert of the Office of Public Road Inquiries, U. S. Department of Agriculture, assisted by leading manufacturers of road machinery; traveled 105,000 miles on railroads, distributed over 1,000,000 pieces of literature, influenced the transfer of over 100,000 passengers on railroads, and expended over \$9,000 to defray necessary expenses.

That this agitation, organization, and education will do great good there can be no doubt. Nearly all of these localities are continuing to organize. Such plans of education should be directed by the Government. A similar campaign should be speedily made in all States, followed up by thorough organization, the distribution of literature, and the construction of sample roads as object lessons.

One hundred thousand dollars annually appropriated for the next five years for this purpose will be none too much. The people of all States want and are willing to pay for practical education. The physical conditions of the Pacific, mountain, prairie, and the Atlantic States are so varied that experts with scientific knowledge should be appointed to visit these great subdivisions and instruct the lawmakers and taxpayers in the most approved methods suited to these various localities. It will require liberal funds to give beneficial and lasting results. The people of many States are now spending annually from \$3,000,000 to \$5,000,000, presumably for road improvement. A large portion of this vast outlay is uselessly frittered away through defective methods of distribution.

The road question is resolving itself into a plain problem of competition. The State or Nation that does not build modern ways of communication can not successfully compete in the markets of the world. It is the duty of Congress; it has the power to appropriate money for educational purposes.

The Office of Public Road Inquiries was created as an educational institution. If it is liberally supported it will become a great national school of road education. This doubtless will prove the most effective channel at present for the Government to extend its aid and influence to improve the highways throughout all States and Territories.

United States Department of Agriculture,

OFFICE OF PUBLIC ROAD INQUIRIES.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROAD INQUIRIES,
Washington, D. C., May 16, 1900.

SIR: The Higbie-Armstrong act, a copy of which is included in the circular submitted herewith, is generally conceded to be the best and most progressive road-improvement act which has yet been passed by any State. In it are incorporated the most desirable features of the State-aid laws of other States, while the objectionable ones have been eliminated, and at the same time the State-aid principle is so modified as to meet the conditions existing in the State of New York. We are indebted to Mr. William W. Armstrong for the notes included in this circular, explaining the provisions and practical operation of the law. It is believed that the circulation of this information will stimulate activity in behalf of better roads throughout the country, and furnish facts upon which laws may be based in other States. I therefore respectfully recommend its publication as Circular No. 35 of this Office.

Respectfully,

MARTIN DODGE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

ROAD IMPROVEMENT IN NEW YORK.

INTRODUCTORY.

The New York law was approved March 24, 1898. Under its provisions a large amount of road building has been undertaken and completed. Edward A. Bond, State engineer of New York, has furnished a statement, from which the facts are taken in the following summary of this work.

As soon as the law went into effect, petitions in accordance with its provisions began to come in at Albany, and in a short time it was evident that the appropriation of \$50,000 for State aid would not meet half the demand. Up to November 29, 1899, a total of 111 petitions were presented, calling for the improvement of 550 miles of road. These were from the counties of Albany, Chemung, Clinton, Columbia, Delaware, Monroe, Oneida, Orleans, Orange, Herkimer, Montgomery, Onondaga, Rockland, Rensselaer, St. Lawrence, Schenectady, and Westchester. In response to the petitions, contracts were let as follows:

Troy and Schenectady turnpike, 2 miles, at a cost of \$14,590; Deerfield Corners, river road, $2\frac{3}{4}$ miles, \$13,808.35; New Lebanon and

Pittsfield road, 6,000 feet, \$7,200; White Corners, plank road between Buffalo and the village of Hamburg, 6.54 miles, \$24,750; East Avenue road, Brighton to Fairport, near Rochester, 2.45 miles, \$10,500; Ridge road, near Rochester, \$36,000; Cortland street road, near Syracuse, \$11,203; James street road, near Syracuse, \$6,715; Troy and Brunswick, \$5,675; Troy and Greenbush, \$7,907.50. For Delaware turnpike near Albany, Waterford road near Saratoga, and Southport road near Elmira, bids are soon to be called for and the contracts let. The preparatory work by the engineer's office for the three was done and an attempt was made to contract for the work, but, for various reasons, the effort was a failure. On the total of \$138,346.85 for these contracts, a total of \$61,683.52 had already been paid out. At the date named, surveys had also been made of sixteen other roads in various parts of the State.

The effect of the law in bringing about the activity shown by these results may be judged from a statement by Supervisor Babcock in regard to the improvements undertaken at Rochester. He said: "Time and time again the board of Supervisors of this county have discussed the matter of road improvement, and up to March 24, 1898, there was nothing upon the statute books of this State whereby any board of supervisors could act in the matter of road improvement in a manner satisfactory to the taxpayers throughout this county." The new law relieved this condition and local officials were enabled to begin improvements.

TEXT OF THE LAW.

The following is a copy of the Higbie-Armstrong law, with forms for the petitions and resolutions provided for in the act.

AN ACT to provide for the improvement of the public highways.

Became a law March 24, 1898, with the approval of the governor. Passed, three-fifths being present.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. The board of supervisors in any county of the State may, and upon presentation of a petition as provided in section two hereof, must pass a resolution that public interest demands the improvement of any public highway or section thereof situate within such county, and described in such resolution, but such description shall not include any portion of a highway within the boundaries of any city or incorporated village, and within ten days after the passage of such a resolution shall transmit a certified copy thereof to the State engineer and surveyor.

SEC. 2. The owners of a majority of the lineal feet fronting on any such public highway or section thereof in any county of the State may present to the board of supervisors of such county a petition setting forth that the petitioners are such owners and that they desire that such highway or section thereof be improved under the provisions of this act.

SEC. 3. Such State engineer, upon receipt of such a resolution, shall investigate and determine whether the highway or section thereof sought to be improved is of sufficient public importance to come within the purposes of this act, taking into account the use, location, and value of such highway or section thereof for the purposes of common traffic and travel, and after such investigation shall certify his approval or disapproval of such resolution. If he shall disapprove such resolution, he shall certify his reasons therefor to such board of supervisors.

SEC. 4. If he shall approve such resolution, such State engineer shall cause the highway or section thereof therein described to be mapped, both in outline and profile. He shall indicate how much of such highway or section thereof may be improved by deviation from the existing lines whenever it shall be deemed of advantage to obtain a shorter or more direct road without lessening its usefulness, or wherever such deviation is of advantage by reason of lessened gradients. He shall also cause plans and specifications of such highway or section thereof to be thus improved to be made for telford, macadam, or gravel roadway or other suitable construction, taking into consideration climate, soil, and material to be had in the vicinity thereof and the extent and nature of the traffic likely to be upon such highway, specifying in his judgment the kind of road a wise economy demands. The improved or permanent roadway of all highways so improved shall not be less than eight feet nor more than sixteen feet in width unless for special reasons, to be stated by such State engineer, it is required that it shall be of greater width. He shall, if requested by the resolution, include provision for steel plate or other flat-rail construction in double track.

SEC. 5. Upon the completion of such maps, plans, and specifications such State engineer shall cause an estimate to be made of the cost of construction of the same and transmit the same to the board of supervisors from which such resolution proceeded, together with a certified copy of such maps, plans, and specifications, and of his certificate of the approval of the highway or section thereof so designated as aforesaid.

SEC. 6. After the receipt thereof, upon a majority vote of such board of supervisors, it may adopt a resolution that such highway or section thereof so approved shall be constructed under the provisions of this act, or of any existing act, and thereupon shall transmit a certified copy of such resolution to such State engineer.

SEC. 7. In case the boundaries of such proposed highway shall deviate from the existing highway, the board of supervisors must make provision for securing the requisite right of way prior to the actual commencement of the work of improvement.

SEC. 8. Upon receipt of the certified copy of the resolution provided in section six, such State engineer shall advertise for bids for two successive weeks in a newspaper published at the county seat of such county, and in such other newspaper as shall be deemed of advantage for the construction of such highway or section thereof, according to such plans and specifications, and award such contract to the lowest responsible bidder, except that he may in his discretion award the contract to the board of supervisors of the county or the town board or boards of the town or towns in which such highway lies, and except that no contract shall be awarded at a greater sum than the estimate provided in section five. But if no bid otherwise acceptable be made within such estimate, such State engineer may amend his estimate, certify the same to the board of supervisors, and upon the adoption by it of a resolution as provided in section six based on such amended estimate, proceed anew to obtain bids and award the

contract as herein provided. Such engineer may reject any or all bids, and before entering into any contract for such construction, he shall require a bond with sufficient sureties, conditioned that if the proposal shall be accepted the party thereto will perform the work upon the terms proposed and within the time prescribed and in accordance with the plans and specifications; and as a bond of indemnity against any direct or indirect damages that shall be suffered or claimed during the construction of such road and until the same is accepted. The people of the State of New York shall in no case be liable for any damages suffered. Partial payments may be provided for in the contract, and paid in the manner herein provided when certified to by such State engineer to an amount not to exceed seventy-five per centum of the value of the work done; twenty-five per centum of the contract price shall be retained until the entire work has been accepted. Whenever a county engineer has been appointed in the county in which such highway or section thereof is to be constructed, he shall have general charge and supervision of the work under the direction of such State engineer and shall report to him from time to time the progress of the work and such facts in relation thereto as may be required. If there is no county engineer, such State engineer shall have some competent person to superintend and have engineering supervision of the work.

SEC. 9. One-half of the expense of the construction thereof shall be paid by the State treasurer upon the warrant of the comptroller, issued upon the requisition of such engineer, out of any specific appropriations made to carry out the provisions of this act. And one-half of the expense thereof shall be a county charge in the first instance, and the same shall be paid by the county treasurer of the county in which such highway or section thereof is, upon the requisition of such engineer, but the amount so paid shall be apportioned by the board of supervisors, so that if the same has been built upon a resolution of said board without petition, thirty-five per centum of the cost of construction shall be a general county charge; and fifteen per centum shall be a charge upon the town in which the improved highway or section thereof is located and if the same has been built upon a resolution of said board after petition as provided in section two, thirty-five per centum shall be a general county charge and fifteen per centum shall be assessed upon and paid by the owners of the lands benefited in the proportion of the benefits accruing to said owners as determined by the town assessors in the next section hereof.

SEC. 10. The town assessors of any town in which any highway or section thereof has been improved or constructed pursuant to petition as provided in section two of this act, shall have power and it shall be their duty upon receiving notice from the board of supervisors of the county in which said town is located, of the cost of construction or improvement of such highway or section thereof in such town, to assess an amount equal to fifteen per centum of said total cost upon the lands fronting or abutting on such highway or section thereof. Such assessment shall be apportioned according to the benefits accruing to the owners of the lands so located, according to the best judgment of said assessors, and the assessments so made when duly attested by the oaths of such assessors shall be collected in the same manner as the general taxes of such town are collected.

SEC. 11. The construction and improvement of highways and sections thereof, under the provisions of this act, shall be taken up and carried forward in the order in which they are finally designated, as determined by the date of the receipt in each case of the certified copy of the resolution provided in section six by such engineer as hereinbefore provided.

SEC. 12. Upon the completion of such highways or sections thereof so constructed by such engineer, and his acceptance of the same, and after payment

has been made, as herein provided, such engineer shall inform the board of supervisors of such county that the highways or sections thereof designated have been constructed as herein provided, and his duties in regard to the same are finished; and he may serve notice on said board to accept such highway thus constructed, which notice shall be filed in the office of the clerk of said county; and twenty days after the service and filing of said notice, such highway or section thereof shall be deemed accepted by said board of supervisors of such county; and thereafter they shall maintain the same as a county road, and apportion the expense as they may be empowered by law.

SEC. 13. All persons owning property abutting on such road so improved, or residing thereon, shall thereafter pay all highway taxes assessed against them in money, in the manner now provided by law.

SEC. 14. Whenever any county has had aid in building any such highway, and it seems advantageous to such State engineer that a section or sections of highway, not exceeding one mile in length, should be constructed under this act to connect these roads together, and would be of great public utility and general convenience, he may serve notice on the board of supervisors of such county, and shall file one in the county clerk's office, designating the highways already constructed and the existing termini and the section or sections, in his opinion, necessary to be constructed and his reasons therefor. And it shall be the duty of the board of supervisors to provide for the construction of such connecting highway or section thereof, within one year after the service and filing of such notice under this act.

SEC. 15. In addition to his other powers and duties, the State engineer and surveyor shall compile statistics relative to the public highways throughout the State, and shall collect all information in regard thereto deemed expedient. He shall investigate and determine upon various methods of road construction adapted to different sections of the State, and as to the best methods of construction and maintenance of roads and bridges, and such other information relating thereto as he shall deem appropriate. He may be consulted at all reasonable times by county, city, town or village officers having care and authority over highways and bridges, and shall advise such officers relative to the construction, repair, alteration, or maintenance of the same; and shall furnish such other information and advice as may be requested by persons interested in the construction and maintenance of public highways, and shall, at all times, lend his aid in promoting highway improvement throughout the State. He shall hold in each year at least one public meeting in each county and shall cause due notice of such meeting to be given. He shall cooperate with all highway officers and shall assist county and town authorities, and when requested by them, furnish them with plans and directions for the improvement of the public highways and bridges.

SEC. 16. He shall report annually to the legislature concerning all the work performed by him, together with such recommendations upon the subject of highway construction and maintenance as to him shall seem appropriate.

SEC. 17. The commissioners of highways and town board of any town, and the board of supervisors of any county, and all other officers who now have or may hereafter have by law the care and supervision of the public highways and bridges shall, from time to time upon his written request furnish him with all available information in connection with the building and maintenance of the public highways and bridges in their respective localities.

SEC. 18. The operation of this act shall not be affected by any special act, but the highways may be improved under this act or such special act wherever the same may now exist.

SEC. 19. This act shall take effect immediately.

FORM NO. 1.

Form of petition for the improvement of a highway, to be signed by the owners of a majority of the lineal feet fronting on such highway.

To the Honorable, the Board of Supervisors of Monroe County:

The undersigned hereby respectfully represent:

1. That they are the owners of real estate fronting upon the following described public highway within the county of Monroe: (here state the points from which and to which the highway runs, and the name of the town or towns in which it lies, as for instance, "the road known as the ——— road, running from ——— in the town of ——— to ——— in the town of ———").

2. That they desire that such highway be improved under the provisions of chapter 115 of the laws of 1898.

Names.	Frontage.

FORM NO. 2.

Form of first resolution to be adopted by the Board of Supervisors to procure from the State engineer plans and specifications, and an estimate of the cost of improving a highway without petition.

Resolved, That public necessity demands the improvement, pursuant to chapter 115 of the laws of 1898, of the following described public highway within the county of Monroe: (here state the points from and to which the highway runs, and the name of the town or towns in which it lies, as for instance, "the road known as the ——— road, running from ——— in the town of ——— to ——— in the town of ———").

FORM NO. 3.

Form of first resolution to be adopted by the Board of Supervisors to procure from the State engineer plans and specifications, and an estimate of the cost of improving a piece of highway after petition.

Whereas, The owners of a majority of the lineal feet fronting on the following described public highway, have petitioned this board for the improvement of such highway, pursuant to chapter 115 of the laws of 1898, therefore

Resolved, That public necessity demands the improvement pursuant to such act of the following described public highway within the county of Monroe: (here state the points from and to which the highway runs, and the name of the town or towns in which it lies, as for instance, "the road known as the ——— road, running from ——— in the town of ——— to ——— in the town of ———").

EXPLANATION OF THE WORKING OF THE LAW.

Through the courtesy of Mr. William W. Armstrong, who introduced and was largely instrumental in securing the passage of the New York law, we make use of the following notes of explanation.

THE PROVISIONS OF THE LAW.

The Higbie-Armstrong good roads bill is the result of several years of hard work and earnest discussion, and from year to year has been altered and modified to meet criticism and opposition. On account of the changes, so made from time to time, there seems to be some confusion about the provisions of the act which was finally approved. An intelligent consideration of the subject, therefore, requires at the outset a brief statement of the provisions of the law.

The act provides that any board of supervisors "may" adopt a resolution declaring that public interest demands the improvement

of a certain piece of highway not located in a city or village, and that upon a petition of the owners of a majority of the lineal feet fronting upon such a highway, it "must" adopt such a resolution.

A copy of this resolution is then to be transmitted to the State engineer, who shall first determine whether the piece of highway indicated is of sufficient public importance to receive State aid; if so, he shall map the highway, cause plans and specifications for the improvement and an estimate of the cost to be made, and transmit copies thereof to the board of supervisors. The board of supervisors, with these facts and figures before them, "may" then adopt a second resolution, declaring that such a highway shall be improved, or it may refuse to go any farther with the matter if it so chooses.

This plan was adopted after a most careful consideration, so as to preserve the principle of home rule to the counties of the State; so that no county could be compelled, if unwilling, to improve any portion of its highway; and so that no county should be permitted to do so until it had all the facts and figures before it.

If a county, therefore, desires merely to know how much it will cost to improve a certain piece of highway, it need only adopt the first resolution and get the plans and estimate of the cost, free of charge, without going any further. If it chooses, after ascertaining the cost, to adopt the second resolution, it may, but it can not be compelled to do so.

If, however, the board of supervisors adopts the second resolution, it must transmit a copy of it to the State engineer, who then advertises for bids for the work. If no responsible bid is made within his estimate, he must make a new estimate and transmit it to the board of supervisors, and if the board of supervisors then adopts a new resolution, based upon the new estimate, declaring that nevertheless such highway shall be improved, the State engineer must advertise for bids as before.

When a responsible bid within his estimate is made the State engineer awards the contract, but if the town¹ or county desires to do the work itself, it has the preference over all bidders. This provision enables localities having scrapers and other appliances for improving their roads to utilize them in doing their own work under this act, and so keep all the money expended at home.

Each board of supervisors has, under the general highway law, the power to elect a county engineer. If it has elected such an officer, the State engineer must act through him. If it has not, he must supervise the performance of the contract himself.

When the work is completed he must draw a warrant upon the State treasurer for one-half the cost of the work, and certify the other half to the board of supervisors, which must levy 35 per cent of the whole cost of the work upon the county. The other 15 per cent is payable in one of two ways, viz: If the board of supervisors adopted the first resolution for the improvement without a petition from the adjoining owners, the board of supervisors must levy the 15 per cent upon the town in which the improved highway is; but if the first resolution was adopted after such a petition, the board of supervisors must cause the town assessors to levy the 15 per cent upon the property owners on the improved highway.

¹ The "town" in New York State, it will be noticed, is a local division of the county corresponding to the township, parish, or civil district of other States.

The act further provides that the improvement of highways shall be taken up in the order in which the final resolutions are received by the State engineer, but he shall not undertake any work in excess of the appropriations for the purpose made by the legislature from year to year.

The appropriation made in 1898 to start the work was \$50,000. This amounts to a tax of 11-1000 of a mill on each dollar of assessed valuation in the State, or 1 1-10 cents per \$1,000; so that the cost to the State of improved highways under this act will be 11-1000 of a mill on the dollar of assessed valuation for each \$50,000 the State appropriates therefor, so long as the assessed valuation remain as now. The first counties to apply will be the first served.

After a highway is so improved the adjoining owners must pay their highway taxes in money, as provided under the general highway law, which permits such highway taxes to be commuted for cash at one-half the regular rates.

In addition to this, the act provides that the State engineer must collect information relative to the public highways, and give to all officers having the care of roads, whether improved or not, such information free. He must furnish them plans and directions for the improvement of roads and bridges free of cost, when requested by them, and they may consult him freely at all times and must aid him in collecting data and statistics.

Such, in brief, is the plan which has finally been approved by the legislature for affording aid in the improvement of rural highways. Although the cities and villages of the State pay about 90 per cent of the entire taxes, not a foot of highway can be improved within their limits. The act is one, therefore, strictly in the aid and for the benefit of rural highways, and by it the legislature has attempted to provide a method for the improvement of the highways and to offer substantial assistance to the communities which will undertake it, but leaves to the communities the decision whether they will take advantage of the offer so made or not. For every dollar so contributed by the State, it provides that another dollar shall be raised by the county and town in which the improved highway lies, but the State of New York is so large and its wealth is so great that the cost to it of this splendid offer is only 11-1000 of a mill on the dollar, or about 1 cent on the \$1,000 of assessed valuation for each \$50,000 so contributed by it.

If one county chooses to improve its roads, and another does not, the county which does not, needs to contribute only 1 cent upon the \$1,000 of assessed valuation for each \$50,000 spent by the State for the purpose of helping the other counties which do undertake to so improve their highways. Surely, no one is so selfish as to begrudge this small contribution; but if they are disposed to criticise the fact that some counties are asked to contribute to the improvement of roads in other counties, the answer is evident that if the county from which such a criticism comes will inaugurate the improvement of its own highways, it can secure back from the other counties the same contribution in return.

PRACTICAL OPERATION OF THE LAW.

This bill presents for the first time in this State a comprehensive plan for the improvement of rural highways. The State may, there-

fore, be deemed to have adopted the principle of such improvement as a part of its economic policy. No one who comprehends the extent to which the prosperity and progress of the State depends upon the condition of its farms and its farmers will criticise this important step. The reason for the interest of the large villages and cities of the State in the movement is evident; for villages and cities would not exist save for the sustaining power of the country about them, and the products of these farms either find a market in these villages and cities, or pass through them to the markets of the world.

But the plan thus presented provides only a method, and does not compel the improvement of a foot of highway. Although comprehensive, it depends upon the localities interested as to whether they will adopt it, and this in turn depends upon whether it is also practical or not.

Whether it is practical or not involves many considerations, but chiefly its cost; and this leads to a brief consideration of its cost, as applied to a particular case, that of Monroe county.

This State is assessed at \$4,506,985,694, and the State appropriation this year for the purposes of this act is \$50,000. The State tax for this appropriation, therefore amounts to nearly 11-1000 of a mill on the dollar of assessed valuation.

Supposing the town of Gates desired to expend on its highways this year \$1,000 in cash under this act, how much would it cost the taxpayers of the town of Gates and how much would it cost the taxpayers of the other towns of this county?

Of this \$1,000 the State will contribute 50 per cent, or \$500; this would be 1-100 of the State appropriation, and the State tax to raise this \$500 would be about 1 cent on \$100,000 of assessed valuation. The county would contribute 35 per cent, or \$350; the county is assessed at \$143,812,809; to raise this \$350, the county tax would, therefore, be 24 cents on the \$100,000 of assessed valuation. The town of Gates would raise 15 per cent, or \$150, and is assessed at \$2,189,267; to raise this \$150 the town tax of Gates would, therefore, be \$6.80 on the \$100,000 of assessed valuation.

It would therefore cost the town of Gates for each \$1,000 of assessed valuation:

For State tax.....	\$.00011
For county tax.....	.0024
For town tax.....	.0680
For total tax .....	.07051

This would be about 7 1-20 cents per \$1,000 of assessed valuation in the town.

And the other towns of the county would contribute to the assistance of the town of Gates for each \$1,000 of assessed valuation:

For State tax.....	\$.00011
For town tax.....	.0024
For total tax .....	.00251

This would be about $\frac{1}{4}$ of a cent per \$1,000 of their assessed valuation, and a taxpayer owning a farm in one of these other towns assessed at \$5,000 would contribute to the assistance of the town of Gates a total tax of only $1\frac{1}{4}$ cents.

This tax of $\frac{1}{4}$ of a cent per \$1,000 would represent the entire cost

to a taxpayer owning land in any other town for the expenditure of \$1,000 by the town of Gates under this bill.

Now, supposing each of the towns of Monroe county determined to expend \$1,000 on its highways under this act, instead of only the town of Gates doing so. This would make a total expense of \$19,000 for all the towns.

Of this amount the State would contribute 50 per cent, or \$9,500; this would be about one-fifth of the State appropriation, and the State tax to raise this one-fifth would be about 22-10000 of a mill on the dollar, or about 2 1-5 mills on the \$1,000 of assessed valuation. The county would contribute 35 per cent, or \$6,500 of the whole amount, being \$350 to each town. The county tax for this purpose would be about 46-1000 of a mill, or about 4 3-5 cents per \$1,000 of assessed valuation.

The following table shows the tax for each \$1,000 of assessed valuation in each town, provided each of the towns expended \$1,000 upon the improvement of the highways under this act:

Tax per \$1,000 for each town in Monroe County, N. Y., to spend \$1,000 each on roads.

Towns.	State tax.	County tax.	Town tax.	Total tax.
Brighton	\$0.0022	\$0.046	\$0.064	\$0.1122
Chili .....	.0022	.046	.069	.1172
Clarkson .....	.0022	.046	.132	.1802
Gates .....	.0022	.046	.068	.1162
Greece .....	.0022	.046	.032	.0862
Hamlin .....	.0022	.046	.103	.1512
Henrietta .....	.0022	.046	.087	.1352
Irondequoit .....	.0022	.046	.094	.1422
Mendon .....	.0022	.046	.060	.1082
Ogden .....	.0022	.046	.077	.1252
Parma .....	.0022	.046	.084	.1322
Penfield .....	.0022	.046	.103	.1512
Perinton .....	.0022	.046	.059	.1072
Pittsford .....	.0022	.046	.092	.1402
Riga .....	.0022	.046	.076	.1242
Rush .....	.0022	.046	.1	.1482
Sweden .....	.0022	.046	.047	.0952
Webster .....	.0022	.046	.117	.1652
Wheatland .....	.0022	.046	.1	.1482

The total tax per \$1,000 of assessed valuation in each of these towns, then, provided they each expended \$1,000 in improving their highways under this act, would be as shown in the following table:

	Cents.
Brighton	11 $\frac{1}{3}$
Chili	11 $\frac{3}{4}$
Clarkson	18
Gates	11 $\frac{3}{5}$
Greece	8 $\frac{6}{100}$
Hamlin	15 $\frac{1}{10}$
Henrietta	13 $\frac{1}{2}$
Irondequoit	14 $\frac{1}{5}$
Mendon	10 $\frac{1}{5}$
Ogden	12 $\frac{1}{5}$
Parma	13 $\frac{1}{5}$
Penfield	15 $\frac{1}{10}$
Perinton	10 $\frac{1}{2}$
Pittsford	14
Riga	12 $\frac{2}{5}$
Rush	14 $\frac{1}{2}$
Sweden	9 $\frac{5}{100}$
Webster	16 $\frac{1}{2}$
Wheatland	14 $\frac{1}{5}$

The following table shows the actual amount of taxes which each town would contribute toward each \$1,000 expended in that town, the balance of each town's \$1,000 coming from other sources than taxation in the town itself:

Actual taxes paid in each \$1,000 raised, by towns in Monroe County, N. Y.

Towns.	State tax.	County tax.	Town tax.	Total.
Brighton	\$5.14	\$109	\$150	\$264.14
Chili	4.73	101	150	255.73
Clarkson	2.49	53	150	205.49
Gates	4.82	102	150	256.82
Greece	8.71	185	150	343.71
Hamlin	3.20	68	150	221.20
Henrietta	3.81	81	150	234.81
Irondequoit	3.49	75	150	228.49
Mendon	5.15	110	150	265.15
Ogden	4.24	90	150	244.24
Parma	3.93	83	150	236.93
Penfield	3.20	68	150	221.20
Perinton	5.53	118	150	273.53
Pittsford	3.58	76	150	229.58
Riga	4.31	91	150	245.31
Rush	3.31	70	150	223.31
Sweden	6.93	147	150	303.93
Webster	2.98	63	150	215.98
Wheatland	3.31	70	150	223.31

In other words, if each of these towns would undertake to expend the amount set opposite it, the State proposes, under this act, to assist each town by contributing to it whatever balance would be necessary to make the amount up to \$1,000. No other State in the Union has ever offered such inducements to its farmers to improve their highways. Probably none other could afford to do so. Certain it is that in none other would the money invested in improving the highways yield a greater return alike to town, county, and State.

COMPARISON OF COST TO TOWNS OF DIFFERING WEALTH.

The question of the cost of improved highways under this act to the taxpayers of the towns wherein the highway lies is to so many the most important one that a further presentation of the facts will not be uninteresting. When the question has been answered in favor of building, only prompt action will insure success, as otherwise the State fund may be exhausted.

The town of Clarkson is assessed at \$1,131,074, Chili at \$2,151,404, and Greece at \$3,959,780. The first of these has the least assessed valuation of any town in the county, the second the nearest to the average assessed valuation of all the towns, and the third the greatest assessed valuation of any town in the county. Any figures based upon these towns, therefore, will show, respectively, the greatest, the average, and the least cost per dollar of assessed valuation.

The State tax for this appropriation, as before stated, amounts to 11-1000 of a mill per dollar of assessed valuation, or 1 1-10 cents per thousand dollars. Let it now be assumed that each town in the county wishes to expend \$5,000 in improving its highways under this bill. The whole amount to be expended in the 19 towns would be \$95,000.

The State's share of this \$95,000 would be 50 per cent, or \$47,500. The county share of this \$95,000 would be 35 per cent, or \$33,250. The county is assessed at \$143,812.809, and the county tax to raise this amount, therefore, would be a trifle over 23-100 of a mill per dollar of assessed valuation. It would amount to about 23 1-10 cents on each \$1,000 of assessed valuation. Each town's share of the \$5,000 to be expended in that town would be 15 per cent of \$5,000, or \$750.

Now, to refer to the three towns selected as containing the least, the average, and the greatest assessed valuation, the tax per \$1,000 dollars to raise \$750 in each town would be as follows:

Tax per \$1,000 to raise \$750, for three towns in Monroe County, N. Y.

Towns.	Assessed valuation.	Tax.
Clarkson.....	\$1,131,074	\$0.66 $\frac{1}{2}$
Chili.....	2,151,402	.35
Greece.....	3,959,780	.23 $\frac{1}{10}$

The whole tax per thousand dollars of assessed valuation in these towns to expend \$5,000 on the highways in each town in the county would be as follows:

Whole tax per \$1,000 to spend \$5,000, for three towns in Monroe County, N. Y.

Towns.	State.	County.	Town.	Total.
Clarkson	\$0.011	\$0.23	\$0.66 $\frac{1}{2}$	\$0.90 $\frac{1}{2}$
Chili.....	.011	.23	.35	.59 $\frac{1}{2}$
Greece.....	.011	.23	.23 $\frac{1}{10}$	.47 $\frac{3}{10}$

This would be a total tax per \$1,000 of assessed valuation of 90 $\frac{1}{2}$ cents in Clarkson, 59 1-5 cents in Chili, and 47 3-5 cents in Greece.

The farmer assessed for \$5,000 in any one of these towns would pay in each year in which there was \$5,000 expended in the improvement of the highways of his town and all the other towns in the county as his total tax for his own and all the other towns, \$4.52 in Clarkson, \$2.96 in Chili, \$2.38 in Greece.

It is apparent, therefore, that the improvement of the highways under this bill will not impose upon the town wherein the highway lies a burdensome tax, but that much the largest portion of the expense will be paid by the State and county.

To illustrate this, the actual proportion of the \$5,000 raised by taxation within each of the three towns named would be as follows:

Proportion of tax in \$5,000 raised, for three towns in Monroe County, N. Y.

Towns.	State tax.	County tax.	Town tax.	Total.
Clarkson	\$12.50	\$261.00	\$750.00	\$1,023.50
Chili.....	23.50	497.00	750.00	1,270.50
Greece.....	43.50	914.50	750.00	1,708.00

The reason for this is that the city of New York pays about 45 per cent of the entire State tax, and all the cities of the State together pay about 88 per cent of the State tax, and in the county of Monroe the city of Rochester pays about 75 per cent of all the taxes imposed upon the county.

So that while each of the towns would receive the benefit of the entire \$5,000 expended within the town, four-fifths of the \$5,000 in Clarkson, three-fourths of the \$5,000 in Chili, and two-thirds of the \$5,000 in Greece would be raised by taxation of the rest of the State and county outside those towns respectively.

It further appears from these figures, that the State and county aid given to towns under this bill is so adjusted that the town of Clarkson, having the least assessed valuation, will receive the greatest amount of contribution from the State and county, the proportion being one-fifth of the \$5,000 raised in town and four-fifths of the \$5,000 raised outside the town, while the town of Greece, with the greatest assessed valuation, will receive the least proportional aid, the amount to be raised in the town being one-third and the amount to be raised outside the town being two-thirds of the \$5,000.

The poorest town, therefore, receives the greatest amount of aid, and the wealthiest town receives the least, which seems to be as it should be.

Highway improvement at this rate of \$5,000 per year in each town would cost \$95,000 per year in the county, a total in ten years of \$950,000; almost a million dollars in the ten years at a cost to the taxpayers in the towns of so little annually, as compared with the benefits received, that no one need fear to see the work undertaken.

If the work is undertaken, however, the towns will be obliged to take the initiative. Not a foot of road can be improved in any city or village under this bill against its wishes, and no locality can be compelled to improve its highways. It remains with the people in the towns to say whether they will do this or not.

COST FOR A GIVEN TOWN TO BUILD FIVE MILES OF IMPROVED HIGHWAY.

There is still another standpoint from which the cost of improving the highways should be considered by the taxpayers of a town, and that is, not what it will cost per dollar of assessed valuation to spend \$1,000 or more upon them, but how much will the improvement of a certain piece of highway cost, both as a whole and per mile; and, while this is an important question to be considered, it is not so easy of determination.

The experience of other States in the improvement of their highways is of little aid; for the condition of the soil, the grades, the drainage, the cost of obtaining the stone, gravel, and other materials, the kind and width of a roadway, and many other elements, enter into the computation, and all affect the cost.

In Ontario County highways have been improved with stone for about \$900 per mile. In Onondaga County many miles of road have been improved with gravel or stone at about \$1,000 per mile, and given such satisfaction that Onondaga County is one of the foremost among the advocates of good roads. Its board of supervisors sent a committee twice to Albany last winter to appear before the legislature in favor of a bill, which was subsequently enacted.

In many other counties of this State systematic road improvement has been begun, with varied experiences. Several towns on Long Island have for some years been engaged in it at their own expense. It is noteworthy that the uniform testimony is that land values have increased wherever the roads have been permanently improved.

In New Jersey, the pioneer State in improvement of highways, much experimenting was done in building roads of various widths from eight feet upwards, and so some money was wasted in getting started; but the system of good roads is advancing rapidly, and the State leads all the other States in mileage. Her people have found the cost to be from \$1,500 to \$3,000 per mile.

In Massachusetts the State adopted the plan of improving isolated pieces of road in different parts of the State, upon the assumption that, having these pieces before them, the people would soon desire to connect them, and so perfect the system. These pieces chosen for improvement were, therefore, often difficult and the quality of the sample pieces excellent, and the expense has been comparatively large.

In passing, it may be added that each of these States began operations by creating a highway commission. The New York act provides for no commission, and is much more liberal in giving aid to local effort. In New Jersey, for instance, the State aid only amounts to about 35 per cent.

The practical determination of the expense of improving a certain piece of highway must be left, therefore, to the engineer who surveys the ground and bases his figures upon a careful consideration of the local and other features. This much may be said: This act does not permit an improvement to be undertaken until plans and specifications and a careful estimate of the expense shall first be made, then transmitted to the board of supervisors of the county, and finally adopted by it. Surely, this throws about the undertaking of the work all the safeguards a careful citizen could desire.

Since the practical solution of this question is not at hand, a theoretical problem may once more be worked out. For this purpose, suppose that the town of Riga wishes to improve five miles of its highways under this act, and that the road, when completed, will have cost \$15,000, or \$3,000 per mile. How much will this work have cost the taxpayers of Riga?

The town of Riga is assessed at \$1,959,710, somewhat below the average assessment for all the towns. Its town tax for this improvement would be 15 per cent of the \$15,000, or \$2,250. The county tax would be 35 per cent of the \$15,000, or \$5,250. The county being assessed at \$143,812,809 to raise this sum, a tax of 36-1000 of a mill on the dollar, or 3 6-10 cents on the \$1,000 of assessed valuation, would have to be levied. The proportion of this county tax to be raised in Riga would be \$70.55. The State tax to raise the appropriation for this year, as has been stated, is 11-1000 of a mill on the dollar of assessed valuation, and the State's contribution of \$7,500 would be about one-seventh of the State appropriation; the tax in Riga for the State's share would be about one-seventh of .000011, or .0000016 on the dollar of assessed valuation, which would be about 1 3-5 mills on the \$1,000 of assessed valuation.

The proportion of this State tax to be raised in Riga would be \$3.13. The account could then be thus stated:

Cost to town for State tax	\$3.13
Cost to town for county tax	70.55
Cost to town for town tax	2,250.00
Total	2,323.68

This shows for the number of miles of roads improved, 5, a cost to the town of Riga of \$464.73 per mile.

For the expenditure of \$464.73 per mile, therefore, the town of Riga would get a road costing \$3,000 per mile. In other words, for every dollar the town expended for this purpose it would get \$5 given to it to aid the work.

Now, how much would it cost the rest of the towns in the county for their share in this contribution to Riga's expenditure? The following table will show:

For State tax as above .....	.0016
For county tax as above .....	.036
Total .....	.0376

This makes for other towns in Monroe County about $3\frac{3}{4}$ cents on the \$1,000 of their assessed valuation.

It thus seems clear that the act is just what it is intended to be, an act to aid towns and counties in the improvement of their highways, and that the aid rendered is not only substantial, but very liberal to the counties which take it up.

The new law, however, does not repeal or alter any existing law; the old highway law is left unchanged for those who prefer it. If towns desire to continue to work on their roads in the old way, it is their privilege. The new plan will not be forced upon them, but it is open to all those who seek it.

It is certainly an important consideration that in the improvement of highways under this act the money expended remains almost entirely in the community which contributes the local tax, which is increased by the contribution from the State.

United States Department of Agriculture.

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MARTIN DODGE, Director.

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Approved:

JAMES WILSON, *Secretary.*WASHINGTON, D. C., *January 20, 1902.*

United States Department of Agriculture.

OFFICE OF PUBLIC ROAD INQUIRIES.

MARTIN DODGE, Director.

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Secretary, R. W. RICHARDSON.

Treasurer, EDWIN A. POTTER.

Address for general officers, 1127 Marquette Building, Chicago, Ill.

Advisory, Hon. MARTIN DODGE, Director, Office of Public Road Inquiries, United States Department of Agriculture.

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Official paper, Triweekly Tribune, New York.

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 Rhode Island Automobile Club, P. O. box 1314, Providence, R. I.
 Automobile Club of Philadelphia, 215 North Broad street, Philadelphia, Pa.
 Pennsylvania Automobile Club, 138 North Broad street, Philadelphia, Pa.
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 Automobile Club of Cincinnati, 30 West Seventh street, Cincinnati, Ohio.
 Dayton Automobile Club, Dayton, Ohio.
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[Two members from each judicial district of the State.]

First district: John B. Uhle, 206 Broadway, New York City; Albert R. Shattuck, 11 Broadway, New York.

Second district: Col. C. H. Weygant, Newburgh, Orange County; Joseph B. See, Valhalla, Westchester County.

Third district: E. J. Bedell, Selkirk, Albany County; Henry McNamee, Fly Mountain, Ulster County.

Fourth district: G. W. Freligh, Niskayuna, Schenectady County; G. H. Whitney, Mechanicville, Saratoga County.

Fifth district: W. Pierrepont White, Utica, Oneida County (chairman of committee); Frank Z. Wilcox, Syracuse, Onondaga County.

Sixth district: Joseph H. Brownell, Windsor, Broome County; Charles T. Chamberlain, 800 South Broadway, Elmira, Chemung County.

Seventh district: Ira P. Cribb, Canandaigua, Ontario County; W. J. Greenfield, Moravia, Cayuga County.

Eighth district: James A. Mensies, Mutual Life Building, Buffalo, Erie County; David Clark, Corfu, Genesee County.

GOOD ROAD CLUB OF NEW YORK.

[New York.]

President, EDWIN V. BRENDON, M. D., 213 West Twelfth street, New York.*Secretary*, R. F. JUNKER, 1036 East One hundred and fifty-sixth street, New York.

NORTH CAROLINA GOOD ROADS ASSOCIATION.

[Headquarters, Raleigh, N. C.]

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Second, E. L. Daughtridge, Rocky Mount, N. C.

Third, Wm. Dunn, Newbern, N. C.

Fourth, Dr. R. H. Lewis, Raleigh, N. C.

Fifth, Judge A. W. Graham, Oxford, N. C.

Sixth, Capt. A. B. Williams, Fayetteville, N. C.

Seventh, R. N. Page, Biscoe, N. C.

Eighth, Hon. Theo. F. Kluttz, Salisbury, N. C.

Ninth, Hon. S. B. Alexander, Charlotte, N. C.

Tenth, H. W. Plummer, Asheville, N. C.

Secretary, J. A. HOLMES, Chapel Hill, N. C.*Treasurer*, Jos. G. Brown, Raleigh, N. C.

SOUTH CAROLINA GOOD ROADS ASSOCIATION.

[Headquarters, Greenville, S. C.]

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TENNESSEE GOOD ROADS ASSOCIATION.

President, S. D. HAYS, Jackson, Tenn.*Treasurer*, H. C. ANDERSON, Jackson, Tenn.*Secretary*, ROBERT L. BURCH, Nashville, Tenn.

VICE-PRESIDENTS.

Chas. L. Dabney (East Tenn.), Knoxville, Tenn., John M. Nichols (West Tenn.),
Dyersburg, Tenn., John C. Ferriss (Middle Tenn.), Nashville, Tenn.

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[Burlington, Vt.]

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VIRGINIA STATE GOOD ROADS ASSOCIATION.

President, H. W. ANDERSON, Richmond, Va.*Secretary-Treasurer*, THOMAS M. WORTHAM, Times Building, Richmond, Va.

FARMERS' GOOD ROADS ASSOCIATION OF WISCONSIN.

[Milwaukee, Wis.]

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EVANS, Jr., Berlin, Wis.

(A county vice-president for each county.)

LOCAL ASSOCIATIONS.

THE NORTH ALABAMA GOOD ROADS ASSOCIATION.

[Headquarters, Birmingham, Ala.]

President, B. F. RODEN, Birmingham, Ala.*Secretary*, J. A. ROUNTREE, Birmingham, Ala.*Treasurer*, W. M. DRENNEN, Birmingham, Ala.

SOUTH ALABAMA GOOD ROADS ASSOCIATION.

[Headquarters, Mobile, Ala.]

President, HENRY FONDE, Mobile, Ala.
Secretary, J. BESTOR ROBERTSON, Mobile, Ala.
Treasurer, A. S. LYONS, Mobile, Ala.

VICE-PRESIDENTS.

Mobile County: John Craft, Mobile, Ala.	Hale County: W. N. Knight, Greensboro, Ala.
Wilcox County: Lee McMillan, Camden, Ala.	Conecuh County: James F. Jones, Evergreen, Ala.
Washington County: R. D. Hooks, Hawthorn, Ala.	Baldwin County: James D. Hand, Dolive, Ala.
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Monroe County: James W. Jones, Jones Mills, Ala.	Clarke County: J. P. Turner, Thomasville, Ala.
Marengo County: James B. Williams, Linden, Ala.	Escambia County: C. Sowell, Brewton, Ala.
Dallas County: B. H. Craig, Selma, Ala.	

CAPITAL CITY WHEELMEN.

[Sacramento, Cal.]

President, J. A. WOODSON, Sacramento, Cal.
Secretary, J. T. SHEEHAN, Sacramento, Cal.

MILLS GOOD ROADS CLUB.

[Sacramento County, Cal.]

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PERKINS GOOD ROADS CLUB.

[Sacramento County, Cal.]

President, THOS. WAITE, Perkins, Cal.
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SACRAMENTO DRIVING CLUB.

[Sacramento, Cal.]

President, ALBERT ELKUS, Sacramento, Cal.
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SACRAMENTO COUNTY GOOD ROADS ASSOCIATION.

[Sacramento, Cal.]

President, M. S. LAVENSON, Sacramento, Cal.
Vice-President, DANIEL FLINT, Sacramento, Cal.
Secretary, F. T. DWYER, Sacramento, Cal.

HIGHWAY COMMISSION OF LOS ANGELES COUNTY, CAL.

[Los Angeles, Cal.]

President, CHAS. CASSATT DAVIS, 408 Bullard Block.
Secretary, WM. H. KNIGHT, 2 Bryson Block.

MARION COUNTY GOOD ROADS ASSOCIATION.

[Ocala, Fla.]

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Treasurer, JAMES CORBETT, York, Fla.
Secretary, CHARLES T. TRASK, Belleview, Fla.

DUVAL COUNTY GOOD ROADS ASSOCIATION.

[Jacksonville, Fla.]

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LAKE COUNTY GOOD ROADS ASSOCIATION.

[Florida.]

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H. T. Dobbin, Altoona, Fla.

H. B. Paxton, Sorrento, Fla.

W. E. Wilson, Clermont, Fla.

E. G. Reaher, Eustis, Fla.

J. A. Tinnor, Luburg, Fla.

LEGISLATIVE COMMITTEE.

Alfred St. C. Abrams, Travans, Fla.

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[Effingham, Ill.]

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TRI-STATE GOOD ROADS ASSOCIATION.

[Cairo, Ill.]

President, GEORGE PARSONS, Cairo, Ill.*Secretary*, JOHN F. RECTOR, Cairo, Ill.

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[Wamego, Kans.]

President, ROBERT SCOTT.*Vice-president*, L. B. LEACH.*Secretary*, CHAS. V. HESSE.*Treasurer*, A. T. McMILLAN.

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[Hopkinsville, Ky.]

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GREEN RIVER GOOD ROADS ASSOCIATION.

[Owensboro, Ky.]

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DARLINGTON GOOD ROADS LEAGUE.

[Darlington, Md.]

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Secretary, C. WILSON, Darlington, Md.

COUNCIL.

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W. H. H. Whiteford, Darlington, Md.	Dr. Ephraim Hopkins, Darlington, Md.
Charles A. Andrew, Darlington, Md.	W. Newlin Smith, Darlington, Md.
Joshua C. Smith, Darlington, Md.	A. Finney Galbreath, Darlington, Md.
Joseph R. Hopkins, Darlington, Md.	Dr. Walter B. Kirk, Darlington, Md.

CONNECTICUT VALLEY HIGHWAY ASSOCIATION.

[Springfield, Mass.]

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Secretary, GEORGE S. PAYNE, Springfield, Mass.
Treasurer, T. B. MOSELEY, Westfield, Mass.

GOOD ROADS ORGANIZATION OF OLMPSTED COUNTY, MINN.

[Organized January, 1902.]

Secretary, CHARLES A. FORBES, Room 11 Court Block, St. Paul, Minn.

PIKE COUNTY GOOD ROADS ASSOCIATION.

[McComb City, Miss.]

President, O. B. QUINN, McComb, Miss.
Secretary, T. L. VENABLE, McComb, Miss.
Treasurer, W. R. CASTON, McComb, Miss.

DOUGLAS COUNTY ROAD IMPROVEMENT ASSOCIATION.

[Omaha, Nebr.]

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Vice-president, Hon. Wm. PAXTON, Omaha, Nebr.
Treasurer, B. B. WOOD, Omaha, Nebr.
Secretary, W. S. POPPLETON (no address given).
Secretary, VICTOR B. CALDWELL, Omaha, Nebr.

GOOD ROADS ASSOCIATION OF BROOKLYN AND LONG ISLAND, NEW YORK.

President, EDWARD H. M. ROEHR, 26 Court street, Brooklyn, N. Y.
First vice-president, FREDERICK H. VAIL, 91 Lafayette avenue, Brooklyn, N. Y.
Second vice-president, FRANK H. TYLER, 1183 Fulton street, Brooklyn, N. Y.
Treasurer, E. W. MERSEREAU, Hotel St. George, Brooklyn, N. Y.
Secretary, EDWARD SCHWALBACH, Jr., 167 Dean street, Brooklyn, N. Y.

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A. A. Goubert.	George T. Stebbins.
C. W. Hewlett.	D. B. Van Vleck.
A. Parker Hamilton.	H. M. Valentine.

Executive committee meets first Monday of every month, at 1183 Fulton street, Brooklyn, N. Y.

Membership fee, 50 cents yearly.

GOOD ROADS LEAGUE OF BROOME COUNTY, N. Y.

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Secretary, FRANK D. LYON, Binghamton, N. Y.
Treasurer, WM. H. HECOX, Binghamton, N. Y.
Chairman executive committee, T. B. CRARY, Binghamton, N. Y.
Attorney, R. A. GUNNISON, Binghamton, N. Y.

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Vice-president, DIXIE HINES, 271 Broadway, New York.
Secretary, EDWIN V. BRENDON, M. D., 213 West Twelfth street, New York.
Chairman roads committee, GEORGE C. WHEELER, 253 Broadway, New York.
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GOOD ROADS ASSOCIATION.

[Headquarters, Richfield Springs, N. Y.]

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Vice-president, GEO. W. TUNNICLIFFE.
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Treasurer, M. A. MCKEE.
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[Headquarters, Winston-Salem, N. C.]

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Secretary and treasurer, O. B. EATON, Winston-Salem, N. C.

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 Guilford County: J. Van Lindley, Pomona, N. C.
 Yadkin County: N. G. Williams, Williams, N. C.
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THE APPALACHIAN GOOD ROADS ASSOCIATION.

[Headquarters, Asheville, N. C.]

President, FRANK LOUGHRAN, Asheville, N. C.
Secretary and treasurer, GEORGE S. POWELL, Asheville, N. C.

GOOD ROADS ASSOCIATION OF ASHEVILLE AND BUNCOMBE COUNTY.

[Asheville, N. C.]

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DIRECTORS.

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James R. Du Bose, Asheville, N. C.	Thomas Wadley Raoul, Asheville, N. C.
Dr. C. L. Minor, Asheville, N. C.	

THE PORTAGE COUNTY GOOD ROADS ASSOCIATION.

[Ravenna, Ohio.]

President, WILLIAM A. HAMMOND.*Secretary*, HENRY M. DEMING.*Treasurer*, ALMON DUNNING.

Organized April 30, 1898.

Regular meetings at Citizens' Hall, Ravenna, Ohio, on the last Saturday of each month at 1 o'clock p. m.

LOGAN WHEELMEN'S ASSOCIATION.

[Altoona, Pa.]

President, G. W. STRATTON.*Vice-president*, Dr. D. M. EASTERN.*Vice-president*, G. D. COOK.*Treasurer*, FRANK HASTINGS.*Secretary*, G. M. ELLSWORTH.

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[Bristol, Pa.]

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[Milroy, Pa.]

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ALLEGHENY COUNTY GOOD ROADS AND TREE PLANTING ASSOCIATION.

[Headquarters, Pittsburg, Pa.]

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W. B. Beck.

D. M. Hornbaker.

F. W. Biesecker.

Walter L. Henwood.

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THE GOOD ROADS ASSOCIATION OF MARLBORO COUNTY.

[Headquarters, Bennettsville, S. C.]

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EXECUTIVE COMMITTEE.

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J. P. Hodges.
W. D. Evans.

John Barrentine.
H. L. McLaurin.
D. J. Esterling.

Chas. Crosland.
P. B. Moore.
Welcome Quick.

CHATTANOOGA DISTRICT GOOD ROADS ASSOCIATION.

[Headquarters, Chattanooga, Tenn.]

President, F. W. FRITTS, Chattanooga, Tenn.
Secretary, J. H. HOGAN, Chattanooga, Tenn.
Treasurer, C. H. BRADFORD, Chattanooga, Tenn.

THE EAST TENNESSEE GOOD ROADS ASSOCIATION.

[Headquarters, Greeneville, Tenn.]

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Secretary, H. R. BROWN, Greeneville, Tenn.
Treasurer, R. M. JONES, Warrensburg, Tenn.

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C. C. Taylor, Milligan, Tenn.	John Four, Bluntville, Tenn.
W. K. Armstrong, Rogersville, Tenn.	W. F. Pash, Dandridge, Tenn.
C. E. Elsworth, Johnson City, Tenn.	W. S. Tipton, Cleveland, Tenn.
J. G. Murray, Bridgeport, Tenn.	

THE ALBEMARLE GOOD ROADS LEAGUE.

[Headquarters, Charlottesville, Va.]

President, H. E. MAGRUDER.
Secretary and Treasurer, J. R. WINGFIELD.

Approved:
JAMES WILSON, *Secretary*.

WASHINGTON, D. C., May 1, 1902.

